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(DE94018833)

A STUDY OF TOXIC EMISSIONS FROM A COAL-FIRED POWER PLANT UTILIZING THE SNOX INNOVATIVE CLEAN COAL TECHNOLOGY DEMONSTRATION

Final Report

Volume 2 of 2 - Appendices

July 1994

Work Performed Under Contract No. AC22-93PC93251

For
U.S. Department of Energy
Pittsburgh Energy Technology Center
Pittsburgh, Pennsylvania

By
Battelle
Columbus, Ohio

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FINAL REPORT

VOLUME 2 of 2 - APPENDICES

on

A STUDY OF TOXIC EMISSIONS FROM A COAL-FIRED POWER PLANT UTILIZING THE SNOX INNOVATIVE CLEAN COAL TECHNOLOGY DEMONSTRATION

Contract DE-AC22-93PC93251

Prepared for

U.S. DEPARTMENT OF ENERGY
PITTSBURGH ENERGY TECHNOLOGY CENTER

by

BATTELLE
Columbus Operations
505 King Avenue
Columbus, Ohio 43201

July 1994

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File: Air Tank

TABLE 5.29 PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 18-July-93

Time	Initials of Personnel Recording Data	SO2 Concentration, ppm		NOx Concentration, ppm		Gas Temperature, F				
		Inlet	Outlet	Inlet	Outlet	SNOX Inlet	SO2 Reactor Inlet	Tower Inlet	WSA Tower Outlet	[illegible]
09:00	K.S.K	2035	83	718	44	~~[illegible]~~ 232	787	505	194	393
09:30	K.S.K.	2005	81	714	46	232	787	505	197	393
10:00	K.S.K.	2097	86	721	44	231	789	505	193	390
10:30	K.S.K.	2041	81	728	51	230	788	506	196	395
11:00	K.S.K	2086	83	732	50	229	788	506	197	393
11:30	K.S.K.	2035	79	734	52	229	787	506	193	393
12:00	K.S.K.	1977	78	750	52	229	790	508	193	395
12:30		1967	77	737	49	230	788	508	195	390
13:00		2010	77	738	50	230	790	508	197	395
13:30		1959	75	730	48	230	787	508	198	393
14:00		1960	76	724	46	231	788	507	197	385
14:30		2009	80	724	45	230	789	506	196	387
15:00	K.S.K	1970	74	744	55	229	788	506	199	385
1530	MMP	2028	77	749	56	231	787	506	198	383
1600		2038	81	737	40	234	788	505	198	385
1630		2023	81	753	42	235	788	505	198	385
1700		2025	81	748	42	235	789	505	198	385
1730		2115	83	746	41	235	788	505	198	385
1800		2089	85	717	41	236	787	505	199	383
1830		2056	84	718	40	236	788	505	199	385
1900		2029	84	704	40	236	787	505	197	383
1930		2138	92	687	39	236	789	505	196	385
2000		2105	84	690	40	236	788	505	196	385
2030		2093	83	694	40	236	789	504	193	385
2100		2067	86	691	40	236	788	504	191	385
2130	MMP	2074	84	701	40	236	788	504	189	388

Project Engineer Review [signature] 10/5/93
Initials/Date

- Each 1/2 hour!
- Data at 0700

7/18/93 Niles SNOX Conditions

July 18, 1993	Ammonia lbs per hr.	inlet Oxygen Reading	SCR outlet temperature	Mid point NOX Reading
8 Am	129	4.2	686	6
9 Am	128	3.9	686	6
10 Am	124	4.0	686	6
11 Am	123	3.8	687	6
12 pm	123	3.6	688	6
1 pm	123	3.6	689	6
2 pm	124	3.7	689	6
3 pm	122	3.7	688	6
4 pm	139	3.3	689	6
5 pm	140	3.5	690	6
6 pm	140	3.2	689	6
7 pm	139	3.7	688	6
8 pm	139	3.4	688	7
9 pm	140	3.6	688	6
10 pm	140	3.4	688	5

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly) 7AM – End of Test

Date: 7-18-93

Time	Initials of Personnel Recording Data	Load, MW Gross	[illegible] Excess Oxygen, percent	Steam temp., F		Drum Steam Pres., psig [illegible]	Throttle Steam Flow, klb/hr
				SH Outlet	RH Outlet		
0700	[illegible]	116	1.52	1000	990	1535	863
0800	[illegible]	116	1.85	1001	990	1532	862
0900	[illegible]	117	1.62	1000	991	1534	862
1000	[illegible]	115	1.41	1002	974	1532	863
1100	[illegible]	117	1.73	1000	986	1533	865
1200	[illegible]	116	1.48	1000	987	1532	865
1315	[illegible]	116	1.91	1000	973	1531	865
1400	[illegible]	116	1.57	1000	982	1535	867
1500	[illegible]	116	1.64	1000	987	1532	866
1600	DG	116	1.24	1000	[illegible]	1534	[illegible]
1700	DG	117	1.43	1000	985	1634	865
1800	DG	117	1.43	[illegible]	[illegible]	1535	868
1900	DG	116	1.57	1000	982	1532	865
2000	[illegible]	[illegible]	[illegible]	999	978	1534	[illegible]
2100	DG	117	1.94	1000	987	1532	867

Project Engineer Review [illegible] 10/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA

(Record data hourly)

Date: 7-18-93

Time	Initials of Personnel Recording Data	Total Coal Flow Klb/hr ~~Stack Oxygen, percent~~ 1C	Stack SO_2, ~~ppm~~ lb/mmbtu 3H	Stack NO_x, ~~ppm~~ lb/mmbtu	Stack Opacity, percent
0700	TP	91.4	1.25	0.75	3.0
0800	TP	92.8	1.35	0.77	3.5
0900	TP	93.2	1.36	0.77	3.0
1000	TP	94.3	1.39	0.87	3.5
1100	TP	92.5	1.37	0.80	3.0
1200	TP	92.9	1.29	0.79	3.5
1315	TP	94.2	1.31	0.81	3.5
1400	TP	93.0	1.27	0.80	3.9
1500	TP	93.6	1.26	0.80	3.0
1600	DG	93.2	1.25	0.74	3.0
1700	DG	93.3	1.27	0.77	3.0
1800	DG	92.0	1.35	0.70	3.5
1900	DG	93.0	1.36	0.70	3.0
2000	DG	93.[illegible]	[illegible]	0.[illegible]	3.5
2100	DG	93.0	1.37	0.66	3.5

Project Engineer Review RB 10/5/93
Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA

(Record data hourly)

Date: 19-July-93

IHC NOx	MID NOX PPM	Time	Initials of Personnel Recording Data	SO2 Concentration, ppm Inlet	SO2 Concentration, ppm Outlet	NOx Concentration, ppm Inlet	NOx Concentration, ppm Outlet	Gas Temperature, F: SNOX Inlet (TE00300 Baghouse)	Gas Temperature, F: Reactor Inlet (SO2)	Gas Temperature, F: Tower Inlet	Gas Temperature, F: Tower Outlet (WSA)	O2 percent	
		08:00	K.S.K.	2086	83	704	41	236	788	504	193		390
		08:30	↑	2054	80	709	40	236	788	504	194		38
		09:00		2015	82	700	40	236	788	505	195		390
		09:30		2090	84	685	40	235	787	504	195		390
		10:00		2070	82	679	40	235	788	504	196	3.1	389
		10:30		2008	80	699	40	235	787	504	196	3.1	390
		11:00		1955	77	716	41	235	788	504	197	3.0	390
		11:30		1999	78	728	40	234	788	504	196	2.6	390
		12:00		1988	78	715	40	235	789	504	193	2.8	387
		12:30		2083	81	715	40	234	788	504	194	2.7	390
		13:00		2113	85	722	40	234	787	505	195	2.4	390
	-	13:30		2049	82	723	39	234	786	505	196	2.6	390
	-	14:00		2065	83	719	39	235	788	505	196	2.9	390
		14:30	↓	2123	84	723	39	235	789	505	195	2.6	390
		15:00	K.S.K.	2208	89	706	39	235	788	505	196	2.3	390
		1530	MMP	2201	91	688	39	235	789	505	197	2.3	387
		1600		2202	93	690	39	234	787	506	199	2.3	389
		1630		2159	88	691	39	381	788	506	200	2.3	389
		1700		2162	89	699	39	381	789	504	202	2.6	
		1730		2143	83	688	39	385	788	504	203	2.9	
		1800		2080	80	712	40	385	787	504	203	2.9	
		1830		2072	79	720	40	385	787	504	202	2.9	
3	5	1900		2087	80	723	43	385	789	504	200	2.8	
18	5	1930		2072	77	709	41	385	786	504	199	2.5	
8	5	2000	↓	2111	81	712	42	385	788	504	199	2.4	
7	4	2030	MMP	2086	80	700	41	386	789	503	197	3.1	
8	4	2100	MMP	2057	79	711	42	386	788	504	196	3.0	
7	5	2130	MMP	2045	77	715	43	385	788	503	195	2.8	

Project Engineer Review RBS 10/5/93
Initials/Date

7/19/93 Niles SNOX Condition

July 19, 1993

	Ammonia lbs per hr.	In-let Oxygen Reading	SCR outlet temperature	mid point NOx Read
8Am	140	3.0	687	4
9am	140	2.7	688	5
10am	139	3.1	687	4
11Am	139	2.9	688	5
12pm	139	2.9	687	5
1pm	137	2.7	687	6
2pm	138	2.9	688	6
3pm	138	2.5	688	6
4pm	137	2.3	688	5
5pm	137	2.6	688	6
6pm	118	2.8	688	5
7pm	118	2.9	687	5
8pm	118	2.7	687	5
9pm	118	3.3	687	4
10pm	117	3.1	686	4

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly)

Date: 7-19-93

Time	Initials of Personnel Recording Data	Load, MW Gears	~~Excess~~ Furnace Outlet Oxygen, percent	Steam temp., F SH Outlet	Steam temp., F RH Outlet	Drum Steam Pres., psig	Throttle Steam Flow, klb/hr
0700	[illegible]	116	1.60	1000	977	1533	867
0800	[illegible]	117	1.47	1001	984	1533	867
0900	J.A.T.	117	1.56	1000	982	1533	867
1000	J.A.T.	117	1.77	1000	982	1533	867
1100	J.A.T.	116	1.5	1000	981	1533	867
1200	J.A.T.	116	1.22	999	980	1536	867
1300	J.A.T.	116	1.14	996	971	1535	869
1400	J.A.T.	116	1.23	1000	975	1535	868
1500	J.A.T.	116	1.08	997	964	1534	870
1600	RDD	116	1.34	1002	965	1534	867
1700	RDD	116	1.20	1000	971	1534	868
1800	RDD	116	1.18	1000	971	1534	868
1900	RDD	116	1.06	1000	979	1533	867
2000	RDD	116	1.33	1000	980	1534	869
2100	RDD	116	1.26	1001	981	1532	868
2200	RDD	116	1.28	999	981	1532	868
			FINISHED				

Project Engineer Review RB 10/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA

(Record data hourly)

Total Coal Flow 1-B 3-A 3-F Date: 7-19-93

Time	Initials of Personnel Recording Data	~~Stack Oxygen, percent~~ klb/hr	Stack SO_2, ~~ppm~~ lb/mm Btu	Stack NO_2, ~~ppm~~ lb/mm Btu	Stack Opacity, percent
0700	JP	92.4	1.14	0.62	3.0
0800	J.P.J.	96.4	1.33	0.64	3.0
0900	J.P.J.	93.3	1.36	0.65	3.0
1000	J.P.J.	93.3	1.36	0.65	3.0
1100	J.P.J.	92.8	1.10	0.67	3.0
1200	J.P.J.	91.7	1.27	0.69	2.6
1300	J.P.J.	91.0	1.25	0.66	2.3
1400	J.P.J.	91.5	1.28	0.69	2.3
1500	J.P.J.	89.8	1.34	0.59	2.3
1600	RDD	90.3	1.30	0.56	2.25
1700	RDD	90.6	1.26	0.60	2.25
1800	RDD	91.7	1.27	0.65	2.25
1900	RDD	92.1	1.35	0.69	2.25
2000	RDD	92.1	1.27	0.66	2.25
2100	RDD	92.3	1.29	0.64	2.25
2200	RDD	93.6	1.25	0.68	2.25

Project Engineer Review RSB 10/5/93
Initials/Date

FILE: AIR TOXICS

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 7-21-93

② SCK OUTLET TEMP	③ MID NOx	Time	Initials of Personnel Recording Data	④ SO_2 Concentration, ppm Inlet	SO_2 Concentration, ppm Outlet	⑤ NO_x Concentration, ppm Inlet	NO_x Concentration, ppm Outlet	⑥ Gas Temperature, F — TOP 0300 SNOX Inlet	⑦ SO_2 Reactor Inlet	⑧ Tower Inlet	⑨ WSA Tower Outlet	⑩ INLET O_2
688	5	08:00	K.S.K.	1845	75	576	48	389	788	504	190	1.7
688	5	08:30	↓	1844	73	585	52	389	788	504	191	1.7
688	6	09:00		Cal	Cal	Cal	Cal	390	790	504	191	Cal.
688	6	09:30		1895	70	609	53	390	788	504	192	1.6
688	6	10:00		1780	69	597	48	389	788	504	195	4.3
688	7	10:30		1925	71	601	55	389	787	504	195	4.1
688	6	11:00		1829	63	610	60	389	787	505	197	4.3
688	7	11:30		1699	57	564	64	391	789	505	195	4.4
688	10	12:00		1846	60	687	71	387	790	505	196	3.9
688	4	12:30		1929	67	675	59	387	787	505	195	3.8
688	5	13:00		1923	67	668	52	385	786	505	196	4.1
688	6	13:30		2091	76	663	50	386	790	505	196	4.1
688	6	14:00		2408	96	656	45	386	788	506	197	3.6
688	6	14:30		2229	89	650	44	386	789	506	198	4.0
688	6	15:00	KSK	2122	81	653	47	387	786	506	197	4.4
688	6	1530	MMP	2171	84	663	48	386	788	506	196	4.2
689	6	1600	↓	2243	86	677	46	388	787	507	197	3.6
689	7	1630		2238	87	668	45	384	790	506	197	4.3
688	6	1700		2135	78	661	54	383	788	506	197	4.4
687	6	1730		2106	79	668	48	384	788	505	196	4.5
687	6	1800		2126	81	665	46	383	789	505	196	4.5
687	6	1830		2020	75	661	48	383	788	505	195	4.8
687	6	1900		2013	70	693	57	384	787	504	194	4.7
686	6	1930		2007	70	691	58	384	789	504	193	4.7
686	6	2000		1978	67	693	60	384	788	504	191	4.9
687	6	2030	MMP	2007	73	702	51	388	787	504	190	4.4
687	5	2100	MMP	1915	69	680	50	388	787	505	188	5.0
688	6	2130	MMP	1873	67	702	56	389	787	505	190	4.8
688	5	2200	MMP	2041	75	706	58	388	789	504	190	4.2
-		2230	MMP									

M E M O

TO: TOM KELLY

DATE: JULY 22, 1993

XC: AIR TOXIC FILE

FROM: TIMOTHY D. CASSELL

SUBJECT: DAILY LOGS OF AIR TOXIC TESTING

Please note that between 0800 and 1000 the inlet 02 reading was lower than normal on the July 21, 1993 daily log. The Horiba instruments were working correctly, however the output was on an incorrect scale thus lowering the presumed value. After correcting the switch position, the readings were corrected.

If you have any questions, please call me at 652-4881.

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Furnace Outlet

Date: 7-21-93

Time	Initials of Personnel Recording Data	Load, MW	~~Excess~~ Oxygen, percent	Steam temp., F SH Outlet	Steam temp., F RH Outlet	Drum Steam Pres., psig	Throttle Steam Flow, klb/hr
1300	[illegible]	116	1.50	994	966	1536	874
1400	[illegible]	115	1.52	986	952	1534	882
1500	[illegible]	116	1.63	996	969	1536	879
1600	RDD	116	1.48	993	970	1537	881
1700	RDD	117	1.67	994	969	1534	878
1800	RDD	117	1.72	996	975	1535	881
1900	RDD	117	1.96	997	978	1535	877
2000	RDD	118	1.90	1000	981	1534	875
2100	RDD	117	1.90	998	984	1534	879

Project Engineer Review [illegible] 11/5/93
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA
(Record data hourly)

Date: 7-21-93

Time	Initials of Personnel Recording Data	Total Coal Flow ~~Stack Oxygen, percent~~ klb/hr	Stack SO_2, ~~ppm~~ lb/mm Btu	Stack NO_x, ~~ppm~~ lb/mm Btu	Stack Opacity, percent
1300	JP	91.3	1.21	0.71	2.6
1400	JP	90.5	1.65	0.74	2.6
1500	JP	90.8	1.57	0.74	2.6
1600	RDB	89.6	1.63	0.75	2.67
1700	RDB	89.2	1.59	0.76	2.67
1800	RDB	91.0	1.57	0.78	2.67
1900	RDB	91.4	1.49	0.84	2.67
2000	RDD	92.9	1.54	0.90	2.67
2100	RDB	92.6	1.46	0.88	4.8

Project Engineer Review RJB 10/5/93
Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA

(Record data hourly)

Date: 7-~~20~~ 22-93

② 7/1 SCR OUTLET TEMP	③ MID NOx	Time EACH 1/2 HR	Initials of Personnel Recording Data	④ SO_2 Concentration, ppm Inlet	Outlet	⑤ NO_x Concentration, ppm Inlet	Outlet	⑥ Gas Temperature, F TBD 0300 SNOX Inlet	⑦ SO_2 Reactor Inlet	⑧ Tower Inlet	⑨ WSA Tower Outlet	⑩ INLET O_2
683	6	08 00	KSK	1954	79	674	40	388	788	500	184	4.4
683	6	30	↑	1925	75	666	39	388	787	500	188	4.9
		09 00										
684	6	30		1947	74	671	41	388	787	501	197	5.1
684	5	10 00		1885	71	680	41	388	787	502	195	4.5
685	6	30		1930	71	685	42	388	788	502	197	4.5
685	6	11 00		1918	71	692	48	389	789	503	198	4.5
687	6	30		1919	69	715	54	387	788	503	197	4.1
687	6	12 00		1930	67	727	58	387	787	503	191	4.2
686	6	30		1960	69	703	54	387	789	503	191	4.6
687	5	13 00		1957	64	721	68	387	787	504	193	3.9
684	5	30		1931	62	716	61	387	787	504	194	4.0
686	6	14 00		1927	61	704	68	385	788	504	195	3.9
686	6	14 30	↓	1955	63	696	64	386	788	504	196	4.0
686	6	15 00	KSK	1947	65	695	60	387	790	504	196	4.2
687	7	1530	SHA	1998	67	688	61	387	788	504	196	5.9
687	6	1600		1993	70	695	55	388	787	505	198	5.9
688	5	30		1932	68	685	50	386	787	505	194	4.1
687	5	1700		1910	61	678	61	389	788	505	195	4.3
687	5	30		1924	69	675	48	387	786	505	196	4.2
687	5	1800		1907	67	676	53	388	789	505	196	4.3
686	7	30		1922	59	676	61	388	788	505	194	4.4
686	5	1900		1943	66	680	61	387	787	504	195	4.0
686	6	30	↓	1914	64	674	67	388	787	504	194	4.4
686	6	2000		1942	67	681	58	387	787	504	196	3.7
686	6	30	SHA	1937	66	674	60	387	788	503	195	4.5

Project Engineer Review RSB 10/5/93
Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA
(Record data hourly)

Date: 7-22-93

2	3			4		5		6	7	8	9	10
SCR OUTLET TEMP	MID NOx	Time	Initials of Personnel Recording Data	SO_2 Concentration, ppm		NO_x Concentration, ppm		Gas Temperature, F				INLET O_2
								TRD 0300	SO_2		WSA	
				Inlet	Outlet	Inlet	Outlet	SNOX Inlet	Reactor Inlet	Tower Inlet	Tower Outlet	
686	6	2100	SHA	1929	68	670	56	389	790	503	193	4.6
686	6	30	SHA	1961	70	659	55	390	788	504	197	4.3

Project Engineer Review RBB 10/5/93
Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Furnace Outlet

Date: 07-22-93.

Time	Initials of Personnel Recording Data	Load, MW	~~Excess~~ Oxygen, percent	Steam temp., F 6B SH Outlet	6A 6B RH Outlet	Drum 6A Steam Pres., psig	Throttle Steam 1A Flow, klb/hr
0800	J.P.T.	116	0.87	993	951	1536	876.63
0900	J.P.T.	117	1.32	996	965	1535	878.97
1000	J.P.T.	117	1.15	997	968	1538	876.94
1100	J.P.T.	117	1.23	999	972	1535	875.53
1200	J.P.T.	117	1.48	998	974	1538	877.59
1300	J.P.T.	117	1.14	996	972	1538	878.64
1400	J.P.T.	117	1.18	996	974	1538	880.09
1500	J.P.T.	117	1.34	999	975	1536	879.17
1600	W.P.R.	117	1.40	995	971	1537	879.59
1700	WPR	117	1.51	996	973	1535	880.20
1800	WPR	117	1.31	999	972	1534	877.48
1900	WPR	117	1.18	999	974	1536	878.44
2000	WPR	117	1.16	1000	974	1536	879.61
2100	Test Completed 20:00						

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Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA
(Record data hourly)

Total 6A Coal Flow 3A 3 H 3H Date: 07-22-93.

Time	Initials of Personnel Recording Data	~~Stack Oxygen~~, ~~percent~~ klb/hr	Stack SO_2, ~~ppm~~ lb/mm Btu	Stack NO_x, ~~ppm~~ lb/mm Btu	Stack Opacity, percent
0800	J.P.T.	89.7	1.32	0.72	2.6
0900	J.P.T.	92.1	1.34	0.70	2.6
1000	J.P.T.	91.2	1.25	0.73	2.6
1100	J.P.T.	92.1	1.30	0.79	2.6
1200	J.P.T.	91.9	1.30	0.87	2.6
1300	J.P.T.	91.4	1.27	0.83	2.6
1400	J.P.T.	92.0	1.28	0.82	2.6
1500	J.P.T.	92.8	1.34	0.81	2.6
1600	W.P.R.	92.5	1.34	0.79	2.6
1700	WP.R.	92.9	1.31	0.77	2.6
1800	WPR.	93.14	1.33	0.75	2.6
1900	WPR.	92.5	1.33	0.77	2.6
2000	WPR	92.3	1.33	0.77	2.6
2100					

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Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA

(Record data hourly)

Date: 7-23-93

① INLET 115/116	② SCR OUTLET TEMP	③ MID NOx	Time	Initials of Personnel Recording Data	④ SO_2 Concentration, ppm Inlet	SO_2 Concentration, ppm Outlet	⑤ NO_x Concentration, ppm Inlet	NO_x Concentration, ppm Outlet	⑥ Gas Temperature, F: TRD 0300 SNOX Inlet	⑦ SO_2 Reactor Inlet	⑧ Tower Inlet	⑨ WSA Tower Outlet	⑩ INLET O_2
116	683	7	08:00	K.S.K	2131	90	637	38	389	790	500	187	3.1
115	683	7	30		1979	70	695	55	388	787	501	188	3.6
115	683	7	09:00		1943	71	696	57	392	788	501	193	3.6
113	684	7	30		1984	71	674	52	388	788	502	193	3.9
111	685	6	10:00		2059	74	678	53	391	789	503	195	3.6
112	685	6	30		2036	73	674	52	391	786	503	197	3.8
113	686	5	11:00		2097	75	690	56	390	788	504	193	3.7
115	687	6	30		2126	80	682	48	389	790	505	194	3.7
111	688	6	12:00		2046	73	672	51	390	786	505	195	3.6
112	688	6	30		2050	74	677	53	390	788	505	196	3.5
114	687	5	13:00		2047	74	674	47	396	789	506	194	3.4
115	688	6	30		2041	74	681	49	387	788	506	195	3.5
118	687	5	14:00		2054	78	669	43	392	788	507	195	3.4
118	687	6	30		2152	81	665	42	384	788	505	196	3.6
118	687	6	15:00	K.S.K	2156	83	674	42	391	788	505	196	3.5
117	689	6	30	SMA	2123	78	689	47	390	789	506	197	3.5
117	689	6	1600		2153	79	687	46	385	787	506	197	3.6
118	689	6	30		2091	79	688	46	386	790	506	198	4.1
117	689	6	1700		2055	75	674	45	384	788	505	199	3.4
			30										
			1800										
			30										
			1900										
			30										
			2000										
			30	SMA									

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Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly)

Date: 07-23-93

Time	Initials of Personnel Recording Data	Load, MW	~~Excess~~ Furnace Outlet Oxygen, percent	Steam temp., F 6B SH Outlet	Steam temp., F 6A 6B RH Outlet	Drum 6A Steam Pres., psig	Throttle Steam Flow, klb/hr
0800	J.P.J.	117	0.62	993	957	1534	879.80
0900	J.P.J.	117	1.11	999	965	1535	878.69
1000	J.P.J.	117	1.20	998	967	1538	880.48
1100	J.P.J.	117	1.19	998	966	1538	880.78
1200	J.P.J.	117	.82	994	962	1535	880.84
1300	J.P.J.	117	1.18	1000	968	1536	879.70
1400	J.P.J.	117	1.02	1000	968	1536	882.08
1500	J.P.J.	117	1.07	997	966	1537	883.06
1600	WPR	117	1.05	992	960	1537	885.9
1700	WPR	117	1.02	991	960	1537	885.7
1800							
1900							
2000							
2100							
2200							
2300							
2400							

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Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA
(Record data hourly)

		Total Coal Flow 3A	3H	3H	Date: 07-23-93
Time	Initials of Personnel Recording Data	~~Stack Oxygen, percent~~ klb/hr	Stack SO_2, ~~ppm~~ lb/mm Btu	Stack NO_x, ~~ppm~~ lb/mm Btu	Stack Opacity, percent
0800	G.P.J.	92.8	1.29	0.63	2.6
0900	G.P.J.	92.6	1.26	0.72	2.6
1000	G.P.J.	91.0	1.30	0.69	2.6
1100	G.P.J.	90.3	1.42	0.75	2.6
1200	G.P.J.	90.8	1.34	0.70	2.6
1300	G.P.J.	91.2	1.41	0.71	2.6
1400	G.P.J.	90.4	1.53	0.69	3.1
1500	WPR	89.9	1.43	0.69	3.1
1600	WPR	90.2	1.41	0.69	3.1
1700					
1800					
1900					
2000					
2100					
2200					
2300					
2400					

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Initials/Date

TABLE 5-29. PROCESS DATA LOG NO. 4: SNOX PROCESS DATA

(Record data hourly)

Date: 7-24-93

① NH3 FLOW lb/hr	② SCR OUTLET TEMP	③ MID NOx	Time	Initials of Personnel Recording Data	④ SO_2 Concentration, ppm Inlet	SO_2 Concentration, ppm Outlet	⑤ NO_x Concentration, ppm Inlet	NO_x Concentration, ppm Outlet	Gas Temperature, F ⑥ TRD 0300 SNOX Inlet	⑦ SO_2 Reactor Inlet	⑧ Tower Inlet	⑨ WSA Tower Outlet	⑩ INLET O_2
			0800	MNP			6						
112	685	6	0830		2153	79	678	43	390	787	503	193	4.0
108	684	6	0900		2125	74	674	54	389	788	504	193	4.0
107	684	6	0930		2151	73	664	53	391	788	504	195	4.0
105	685	6	1000		2174	74	663	53	390	786	504	196	3.7
107	684	6	1030		2138	75	657	53	390	787	504	198	4.0
107	686	5	1100		2139	75	651	51	389	787	504	199	3.9
105	686	6	1130		2041	66	685	63	390	788	504	204	3.9
105	686	7	1200		2067	63	683	64	386	787	505	206	3.9
115	687	6	1230		1987	66	686	49	387	788	504	200	4.2
113	687	6	1300		1988	65	693	53	388	788	505	198	4.0
116	688	5	1330		2097	69	694	51	384	787	505	200	3.9
115	688	5	1400		1999	65	684	50	383	787	504	201	4.3
109	687	5	1430		2076	71	699	50	384	788	504	196	4.0
110	687	5	1500	MNP	2052	65	697	63	383	787	504	196	3.9
111	687	6	30	SMA	2046	65	707	63	386	790	504	198	4.1
112	687	6	1600		1985	60	686	63	383	787	504	199	4.5
110	687	6	30		2005	57	715	68	383	788	505	198	4.5
109	687	6	1700		1969	56	716	71	382	788	505	198	4.1
116	688	5	30		1984	65	684	48	384	787	504	199	4.1
117	687	6	1800		2076	73	674	44	384	788	504	200	3.7
117	688	6	30		2100	71	690	50	383	787	504	199	3.8
117	688	5	1900		2045	68	662	44	383	789	504	197	4.3
				SMA									

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Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Furnace Outlet

Date: 24 July 1993

Time	Initials of Personnel Recording Data	Load, MW	~~Excess~~ Oxygen, percent 1A	Steam temp., F 6B SH Outlet	Steam temp., F 6A 6B RH Outlet	Drum 6A Steam Pres., psig	Throttle Steam 1A Flow, klb/hr
0800	MEP Jr.	116.5	1.43	999	969	1534	872.42
0900	RDD	117.5	1.77	1000	978	1536	874.31
1000	RDD	117.1	1.44	1000	976	1536	874.97
1100	RDD	117.1	1.54	1000	974	1537	874.02
1200	RDD	117.3	1.28	999	978	1537	874.33
1300	RDD	117.3	1.37	1000	981	1535	876.00
1400	RDD	117.5	1.63	1000	981	1537	878.23
1500	RDD	117.2	1.50	999	977	1536	877.28
1520	Increased O_2	Master	from 70% - 75%			WPR	
1600	WPR	117.2	2.01	1000	983	1534	877.6
1700	WPR	117.5	1.57	1000	985	1535	878.5
1800	WPR	117.0	1.3	999	975	1537	878.6
1900	WPR	117.5	1.8	1000	985	1534	878.3

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Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA
(Record data hourly)

Date: 24 July 1993

Time	Initials of Personnel Recording Data	Total Coal Flow 6B 3A ~~Stack Oxygen~~, ~~percent~~ klb/hr	2H Stack SO_2, ~~ppm~~ #/MMBtu PRIMARY	3H Stack NO_x, ~~ppm~~ #/MM Btu PRIMARY	Stack Opacity, percent
0800	MEPJr	90.25	1.59	0.75	3.10
0900	RDD	90.3	1.62	0.79	3.56
1000	RDD	90.3	1.63	0.71	3.56
1100	RDD	90.0	1.64	0.73	3.56
1200	RDD	89.6	1.56	0.80	3.56
1300	RDD	91.4	1.46	0.84	3.56
1400	RDD	90.7	1.49	0.83	3.10
1500	RDD	90.8	1.50	0.83	3.16
1600	WPR	91.6	1.51	0.89	3.0
1700	WPR	91.1	1.45	0.86	3.1
1800	WPR	90.2	1.51	0.74	3.0
1900	WPR	91.3	1.59	0.82	3.0

FROM 0925-0929 | SO_2 READ 4.63

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Initials/Date

APPENDIX B

AUDITING

AUDITING

B-1. Introduction

During the week of July 18-24, while Battelle and Chester staff conducted six days of solid, liquid, and flue gas sampling at the SNOX process, Research Triangle Institute (RTI) conducted technical and performance audits of the field effort. Those audits took place on July 20 and 21, 1993.

The RTI activities included technical audits, performance audits, and CEM calibrations. Those separate activities are discussed in Sections B-2 through B-4, respectively. The RTI Field Sampling Audit Report for Niles Station is included at the end of this Appendix.

B-2. Technical Audits

The following are responses to specific comments made by RTI; these are organized under the same headings and in the same order as the original comments in the enclosed RTI report.

Findings

(1) There is no intent of assigning all of the probe rinse particulate to any one particle size fraction. This material is considered as a separate component, for example in discussion of particle size distributions in Section 7.3. Given the constraints of flue gas sampling at the baghouse inlet, there was no alternative to use of the extractive sampling mode.

(2) The glass cyclones were designed to provide the desired particle size cuts, and to be accommodated within a Method 5 heated box along with the particulate filter. Insufficient time was available before the field study to conduct verification tests, but

the flow rates used in the field were appropriate for achieving the desired 10 μm and 5 μm size cuts.

(3) It is not entirely clear from the RTI comment which probe had the worn insulation at Location 19. In any case, as the RTI auditors noted, the impact on the data is probably insignificant. Comparison of measurements at Locations 18 and 19 (e.g., probe rinses) would not provide any useful information on probe differences, because of the great difference in flue gas composition at these sites upstream and downstream of the baghouse.

(4) The Fyrite solutions used by Chester for O_2 measurements were replaced regularly, following this comment from the RTI auditors.

(5) No response needed.

(6) Blank samples were taken of all reagents made up with the deionized water, for blank subtraction.

(7) The impact on data should be minimal, since gas flow/reagent volume ratios were similar with the two sizes of glassware.

(8) The potential for some effect from SO_2 in the flue gas is real, however, it is not clear how "bleaching" of DNPH solution by SO_2 could be greater in the second impinger than in the first. The procedure used was discussed with knowledgeable staff at U.S. EPA prior to the study, and the aldehyde results appear reasonable (see Section 5.7).

(9) The impact on ash composition data is almost certainly negligible, given the ample quantities of ash collected, and the small amount of damage to the sampling device.

(10) The selection of which baghouse hoppers to sample was not based on an assumption by Battelle, but upon consultation with ABB staff concerning the quantities of material collected in each hopper. Compositing of the baghouse samples also reduces the impact of any inhomogeneities. Note that only composite samples were analyzed, so differences in the ash composition from different hoppers cannot be discerned from the analytical data.

Observations

(1) No comment needed.

(2) No comment needed.

(3) *This comment refers to an issue that field staff were not qualified to address.* Careful review of analytical data has been conducted in compiling data for this report, and in preparing study data for the PISCES data base format.

Recommendations

(1) This recommendation appears to contradict the comments made by RTI under Findings, Item 5. No critical weighings were conducted in the field, so NIST-traceable weigh checks are unnecessary.

(2) Reagent blanks were analyzed for all sampling methods, and the data shown in this report have been properly corrected.

(3) The scope of this study does not include such an investigation. As noted above, guidance from U.S. EPA indicates the method should not be invalidated by elevated SO_2 levels.

(4) The use of such a model would be very prone to error, given the frequently changing configuration of the probe and flexible line combination. No useful information would be obtained from such an effort.

(5) Validation testing such as that suggested is beyond the scope of the present study, though it may be of value in future work. Given that the cyclones were used at only one location having a very high particulate loading, such an effort would have minimal effect on the results of this study.

(6) During sampling subsequent to the audit, the Fyrite sample solutions were changed regularly to avoid use of aged solutions.

B-3. Performance Audits

As indicated in the enclosed RTI Field Sampling Audit Report, RTI performed Performance Evaluation Audits (PEA) by spiking sampling materials with target analytes. Tables B-1, B-2, B-3, and B-4 show the results of analyses of the spiked samples for metals, PAH, VOST, and aldehydes, respectively For each spiked sample, the mass of analyte found by Battelle, the mass of analyte spiked into the sample as reported by RTI, and the percent recovery of the spiked analyte are shown. The significance of these results is discussed according to analyte class in the following paragraphs.

Metals

As shown in Table B-1, six of the recoveries for the PEA samples are outside of the range of 70 to 130 percent. Battelle's accuracy requirement for metals was 80 to 120 percent recovery for certified standard materials. Since the PEA samples are not certified standards, and since analyte losses may have occurred during spiking, a wider range for these analyses is considered acceptable.

For the filter samples, mercury and selenium showed lower recoveries than the other three analytes (excluding cadmium in N-18-MUM-721). This result is attributed to the potential losses of these compounds during the spiking process or during sample handling, preparation, and analysis.

The 55 percent recovery for cadmium in N-18-MUM-721 filter is considered an outlier since cadmium recoveries for all other samples are acceptable.

The 44 percent recovery for selenium in N-18-MUM-721 is attributed to the low spike level and the anticipated lower analytical accuracy near the detection limit of a method. The detection limit for selenium in prepared H_2O_2 impinger solution was 0.01 mg/L; the detected level in N-18-MUM-721 was 0.07 mg/L. This low selenium recovery is not expected to occur in actual samples because selenium levels in most samples were found at much higher concentrations.

PAH

As shown in Table B-2, recoveries for almost all of the PAH in the PEA samples were between 50 to 150 percent. This accuracy limit was established on this project for recovery of deuterated PAH spiked into samples prior to extraction and is reasonable to use as a limit for the PEA samples.

The low recovery of the volatile PAH naphthalene results principally because this compound was spiked onto blank filters rather than onto particulate matter on filters. Volatile PAH are more stable on particulate matter than on blank filters. Much of the spiked naphthalene was likely lost from the blank filters during sample handling and transporting. Acenaphthylene and acenaphthene are similarly volatile and also showed slightly lower recoveries on the filter PEA samples in comparison to the other PAH. An alternative approach to spiking would be to spike collected filter samples with deuterated PAH. The low recovery for naphthalene on the filter PEA samples is not expected to affect sample results since this volatile PAH would be bound on particulate in actual filter samples and less susceptible to the losses described here.

The recovery (162 percent) for dibenzo(a,h)anthracene was higher than 150 percent for one of the four PEA samples. Since all the recoveries for other PAH in this sample were in the acceptable range, this high recovery is probably due to contamination in the field spiking process, or in the sample handling, or in the laboratory. However, this high recovery should not affect sample results because dibenzo(a,h)anthracene was not detected in the field blanks and laboratory method blanks.

VOST

For the majority of the VOST compounds, recoveries of the spiked compounds into the PEA samples were within 26 to 160 percent. This accuracy limit was established for recovery of surrogate spikes from VOST samples and is reasonable to use as a limit for PEA samples.

B-4. CEM and Sensor Audits

As described in the enclosed RTI report, RTI audited Battelle's paramagnetic O_2 analyzers, Chester Environmental's Fyrite O_2 analyzers, dry gas meters from both groups, and SO_2 and NO_x CEM instruments operated by ABB at the SNOX facility. Results of these audits are tabulated in the enclosed RTI report. Battelle's dry gas meter results, noted in the RTI report, were provided to RTI, and to the best of our knowledge agreed within a few percent with the RTI audit.

B-5. Battelle's Audits

A copy of Battelle's internal audit report on the project is included as the last portion of this appendix.

B-6. Results from Coal Analysis Round Robin

Results from the coal analysis round robin coordinated by Consol, Inc. (Consol) for DOE/PETC are presented in Tables B-5 and B-6 for Samples F and O, respectively, which are the duplicate samples generated from Niles coal provided by Battelle to Consol.

A comparison of the average round robin results for Niles coal from all five laboratories participating in the study with the results provided in Section 5 of this report for Niles boiler feed coal is provided in Table B-7. In general, the relative percent difference between the average results for detected elements in the boiler feed coal presented in Table 5-10 and the average result obtained for Niles coal (designated Samples F and O) by the five laboratories participating in the round robin study was less than 30 percent.

Antimony, arsenic, cadmium, copper, molybdenum, nickel, and selenium had relative percent differences above 30 percent; at 75 percent, 33 percent, 116 percent, 35 percent, 56 percent, and 91 percent, respectively. The large cadmium and molybdenum relative percent differences were due to the non-detect results obtained for each. For antimony and copper, the laboratory procedures apparently did not recover these elements as expected. Although the arsenic and nickel relative percent differences were above 30 percent (33 percent and 56 percent, respectively), the percent relative standard deviation associated with each in the round robin study was also relatively high (averages of 36.2 percent and 33.1 percent, respectively) which suggested that the round robin results were not more accurate than the result presented in Table 5-10. The round robin study also demonstrated that the large relative percent difference for selenium (91 percent) was not unusual given the poor accuracy of the round robin results for this element.

TABLE B-5. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE F

TRACE ELEMENTS	LAB I RUN 1	LAB I RUN 2	LAB II RUN 1	LAB II RUN 2	LAB III RUN 1	LAB III RUN 2	LAB IV RUN 1	LAB IV RUN 2	LAB V RUN 1	LAB V RUN 2
				PPM DRY WHOLE COAL BASIS						
As	4.82	50.43	35.51	35.07	17	17	24	ND	28.7	28.1
B	89.23	96.74	64.7	63.46	73	76	68	65	64.9	53.4
Ba	55.38	53.51	86.4	98.1	93	85.6	83	83	59	87.3
Be	2.67	2.78	2.14	2.18	1.9	2	2.3	2.4	2.75	2.41
Cd	0.07	0.09	0.1	0.12	<0.3	<0.3	<0.4	<0.4	0.093	ND
Cr	22.56	22.64	25.35	26.97	19.7	21.7	20	21	11	14.4
Co	9.74	11.32	5.9	5.86	6.23	6	8	7	4.56	3.59
Cu	21.54	21.61	17.35	17.07	<37.8	<37.4	20	21	22.2	29
F	<100	<100	90.46	92.55	90	100	ND	ND	63	65
Hg	0.21	0.27	0.238	0.251	0.24	0.26	0.25	0.25	0.336	0.323
Mn	25.64	15.73	26.6	26.6	27	23.2	30	31	25.5	26.6
Mo	7.36	6.48	4.25	4.46	3.65	3.8	<6	<6	1.92	1.51
Ni	26.67	29.64	21.96	22.39	26.8	28.2	25	28	23.5	23.6
Pb	7.26	<0.6	15.67	15.66	15	15	16	17	12.3	11.5
Sb	1.95	2.88	2.2	2.25	1.97	2.1	2	2	ND	ND
Se	1.13	2.26	3.27	3.29	2	2	3	ND	1.5	2.2
V	40	42.19	26.06	27.96	33.6	36.3	35	36	35.5	36.2
				% DRY BASIS						
PROXIMATE & ULTIMATE										
ASH	13.42	13.42	13.42	13.45	13.44	13.4	13.21	13.27	13.39	13.37
CARBON	66.75	66.24	71.23	71.11	71.34	71.36	70.41	70.23	69.96	69.94
HYDROGEN	5.3	5.26	4.76	4.77	4.94	4.86	4.63	4.56	4.77	4.75
NITROGEN	1.39	1.35	1.43	1.43	1.45	1.39	1.39	1.35	1.26	1.32
SULFUR	3.1	2.96	2.9	2.95	3.1	3	2.96	2.99	3.16	3.13
CHLORINE	0.6	0.05	0.155	0.14	0.119	0.122	ND	ND	0.12	0.13
Btu/lb	12207	10953	12674	12646	12645	12609	12665	12666	12623	12583
				% DRY ASH						
MAJOR ASH ELEMENTS										
SiO_2	45.66	49.3	47.16	46.04	ND	ND	44.91	ND	46.1	45.3
Al_2O_3	23.1	24.62	23.19	23.37	22.98	23.97	22.55	ND	22.1	22.2
TiO_2	1.12	1.23	1.06	1.07	1.3	1.12	1.12	ND	1	1
Fe_2O_3	20.76	23.02	21.68	22.01	20.9	19.67	ND	ND	21.4	21
CaO	1.16	1.07	1.85	1.91	1.44	1.36	ND	ND	1.7	1.8
MgO	0.43	0.33	0.67	0.67	0.73	0.66	ND	ND	0.66	0.66
Na_2O	0.22	0.21	0.3	0.3	0.25	0.25	0.36	ND	0.24	0.26
K_2O	2.39	2.22	2.3	2.32	1.92	2.11	2.05	ND	2.2	2.2
P_2O_5	0.47	0.53	0.48	0.46	0.69	0.69	ND	ND	0.45	0.46
SO_3	ND	ND	1.76	1.83	ND	ND	ND	ND	1.53	1.49

TABLE B-6. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE O

TRACE ELEMENTS	LAB I RUN 1	LAB I RUN 2	LAB II RUN 1	LAB II RUN 2	LAB III RUN 1	LAB III RUN 2	LAB IV RUN 1	LAB IV RUN 2	LAB V RUN 1	LAB V RUN 2
					PPM DRY WHOLE COAL BASIS					
As	46.12	35.85	34.96	36.04	21	18	27	ND	29.4	31
B	99.41	74.78	58.5	62.38	73	77	72	80	54.5	47.8
Ba	53.29	48.15	84.8	86.2	107	100	85	89	ND	85
Be	2.97	2.25	1.9	2.03	2.7	2.4	2.1	2.4	2.58	2.61
Cd	0.11	0.06	0.14	0.13	<0.3	<0.3	<0.4	<0.4	0.11	ND
Cr	22.55	18.44	20.68	19.39	21	22.6	20	20	13.3	13.9
Co	9.74	9.12	5.9	6.16	6.67	7.72	8	7	4.6	5.8
Cu	23.57	18.44	17.81	18.62	<31	<32.6	22	22	22.7	23.5
F	0.01	0.1	80.03	66.12	90	90	ND	ND	73	73
Hg	0.14	0.3	0.248	0.273	0.23	0.23	0.2	0.2	0.399	0.353
Mn	26.64	21.51	27.2	24.8	27.4	30.4	30	31	26	26.4
Mo	10.25	5.33	4.05	4.09	5.09	5.66	<6	<6	1.85	2.79
Ni	27.67	21.51	21.12	22.1	54.5	61.9	26	25	23.7	24.1
Pb	9.94	11.27	15.29	15.14	17	20	19	18	10.5	9.7
Sb	2.15	1.43	2.09	2.17	1.85	1.78	2	2	2.6	2.4
Se	2.05	2.15	3.39	3.37	2	3	3	ND	3.3	2.2
V	44.07	33.8	28.47	30.13	32.3	32.1	28	26	35.6	36.6
					% DRY BASIS					
PROXIMATE & ULTIMATE										
ASH	13.29	13.46	13.32	13.3	13.28	13.4	13.12	13.16	13.31	13.46
CARBON	69.61	69.56	71.35	71.16	71.19	71.46	70.38	70.79	70.5	70.66
HYDROGEN	5.06	5.24	4.82	4.78	4.91	5	4.8	4.65	4.76	4.79
NITROGEN	1.3	1.31	1.34	1.47	1.41	1.37	1.36	1.38	1.33	1.35
SULFUR	3.08	3.1	2.92	2.97	3.02	2.99	3.01	3.04	2.93	2.91
CHLORINE	0.02	0.02	0.13	0.13	0.127	0.13	ND	ND	0.12	0.12
Btu/lb	11774	11530	12737	12720	12654	12655	12690	12708	12644	12637
					% DRY ASH					
MAJOR ASH ELEMENTS										
SiO_2	52.66	39.14	46.16	46.9	ND	ND	42.89	ND	45.3	45
Al_2O_3	24.76	20.13	23.46	23.32	20.52	20.27	21.3	ND	22.5	22.6
TiO_2	1.29	0.96	1.09	1.08	1.03	1.02	2.32	ND	[illegible]	1.1
Fe_2O_3	23.15	17.41	22.26	22.17	20.6	22.79	ND	ND	21	21.4
CaO	1.19	0.97	1.64	1.6	1.31	1.22	ND	ND	1.7	1.7
MgO	0.37	0.44	0.68	0.67	0.63	0.77	ND	ND	0.85	0.85
Na_2O_3	0.24	0.21	0.31	0.29	0.25	0.25	0.36	ND	0.47	0.44
K_2O	2.51	2.11	2.32	2.32	2.27	2.33	1.72	ND	2.2	2.2
P_2O_5	0.53	0.4	0.46	0.47	0.97	0.85	ND	ND	0.49	0.53
SO_3	ND	ND	1.83	1.75	ND	ND	ND	ND	1.74	1.74

TABLE B-7. COMPARISON OF BOILER FEED COAL RESULTS WITH ROUND ROBIN RESULTS

Analyte	Average Table 5-10 Result (μg/g, as received)	Average Table 5-10 Result (μg/g, dry)*	Average Round Robin Result (F/O) (μg/g, dry)	Relative Percent Difference
Aluminum	13700	14600	15925	9
Antimony	0.9	0.96	2.1	75
Arsenic	34	36	26	33
Barium	63	67	76.1	13
Beryllium	2.27	2.41	2.37	2
Boron	53	56	70.7	23
Cadmium	ND< 0.3	ND< 0.319	0.085	116
Chromium	15	16	20	23
Cobalt	5.4	5.7	6.95	19
Copper	14	15	21.2	35
Lead	13	14	13.6	2
Manganese	27	29	26.5	8
Mercury	0.26	0.28	0.26	6
Molybdenum	ND< 3	ND< 3.19	4.54	35
Nickel	15	16	28.2	56
Potassium	2000	2100	2405	14
Selenium	0.9	0.96	2.56	91
Silicon	24600	26100	28499	9
Sodium	300	319	297	7
Titanium	767	815	976	18
Vanadium	26	28	34	21

*Calculated using average moisture value of 5.9 percent for boiler feed coal.

RESEARCH TRIANGLE INSTITUTE

RTI/5960/193 - 07D August 12, 1993

QA/QC AUDITS ON DOE UTILITY BOILER TEST PROGRAM

FIELD SAMPLING AUDIT REPORT

Site: Niles Station Unit 2, Niles, OH

DOE Contractor: Battelle

DOE Project Officer: Robert Evans

Performed for

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RTI Work Assignment Leader: Shirley J. Wasson

Under EPA Contract No. 68D10009
Work Assignment No. I-193

Field Audit of:

Niles Station Unit 2
Ohio Edison
Niles, OH

Contractors: Battelle Memorial Institute
Chester Environmental
Dates: July 20 and 21, 1993
RTI Personnel: J.B. Flanagan and L.L. Pearce

Introduction

Niles Station Unit 2 is owned and operated by the Ohio Edison system and is located adjacent to the Mahoning River just south of Niles, Ohio. Unit 2 is a cyclone coal-fired boiler, burning bituminous coal from various sources. The coal has an average sulfur content of 3.0 percent. Typical gross electrical generation at full load is 100 MW. To maintain full load, four star-valve feeders supply approximately 44 tons per hour of coal into four burners. Approximately 20 to 30 percent of the ash in the coal is fly ash. An electrostatic precipitator (ESP) is the principal control for entrained fly ash. The rest of the ash, approximately 70 to 80 percent, is retained as molten slag in the bottom of the boiler and then drained into a tank filled with water.

A slipstream exits unit 2 prior to the ESP and is routed to the Innovative Clean Coal Technology Wet Gas Sulfuric Acid - Selective Catalytic Reduction of NO_x (ICCT WSA-SNOX) pilot plant managed by ABB Combustion Engineering. The WSA-SNOX process provides SO_2 and NO_x control on 35 percent of the flue gas from unit 2. There are no SO_2 or NO_x control systems for the remaining 65 percent of the flue gas. The WSA-SNOX process uses a selective catalytic reactor for the removal of NO_x and an SO_2 catalytic reactor in sequence with a cooling tower to convert SO_2 to sulfuric acid.

During the audit, the Niles plant had repeated operational problems with one of the four coal feeders. On Tuesday, July 20, sampling was postponed because of this problem. By 1:00 p.m. on Wednesday, July 21, this had been resolved, and a full day of organic sampling commenced. Thus, the entire sampling schedule was shifted.

Despite the schedule change, the auditors were able to complete all performance evaluation audits (PEAs) and audit questionnaires. In addition, more time was available on Tuesday and on Wednesday morning to interview the sampling personnel and to examine records. The auditors departed the site at approximately 6:00 p.m. on Wednesday.

Findings

1. Finding: **Particulate fractions data may be compressed because cyclones were operated in an extractive mode instead of in the stack.** In-stack sampling could not be performed because the ports were too small to allow the cyclones to pass through. Obtaining the sample required a sample probe and flexible Teflon line. According to Tom Kelly, up to 15 feet of tubing (probe length plus flexible line) were needed when performing a full traverse. When performing single-point sampling, shorter tubing runs were used. Battelle will wash the probe and lines to recover any particulate material lost.

   Effect on Data: Extractive versus in-stack cyclone sampling may lead to different results because of particle loss in the probe and lines. Depending on the gas flow rate, tubing diameter, tubing length, and aerodynamic diameter particle loss will vary.

   Rinsing the probe and flexible line is a good idea, but assigning all of this material to the first size fraction is questionable. See the Recommendation section of this report for a suggested investigation that might help clarify this issue.

2. Finding: **Glass cyclones of new design were used to collect particulate for size-fractionated analysis of metals.** According to George Sverdrup, these cyclones were of an original Battelle design and were developed specifically for this program and fabricated only weeks prior to the Niles field testing.

   Effect on Data: Unknown. Using all-glass cyclones should eliminate the chance of metal contamination that is possible with the use of metal cyclones, but because the cyclones were fabricated only a few weeks before the test, it is not known if validation testing was adequate.

3. Finding: **On one of the probes operated by Battelle, there was insufficient insulation to shield the thermocouple that controlled the temperature of the probe at 250°F from the high temperature flue gas.** Consequently, when the thermocouple entered the duct, approximately half-way into the traverse, the temperature controller shut down thereby allowing the portion out of the stack to drop below 250°F. In Figure 1, the controller is controlling the probe heater to heat the probe to 250°F. In Figure 2, the controller is turned off. The probe inside the duct is at a high temperature, ~380°F, while the probe outside the duct is at a lower temperature, ~198°F, measured by Battelle.

   Effect on Data: A few feet of the probe below 250°F seems unlikely to cause significant problems. This probe, operated at sampling point #19, should be compared with the probe at point #18 (which had adequate insulation) for evidence of any unexpected difference in probe rinse concentrations due to condensation in the unheated section.

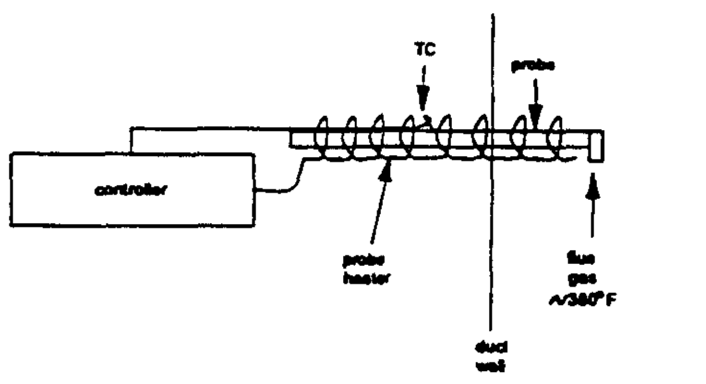

Figure 1. Thermocouple outside duct.

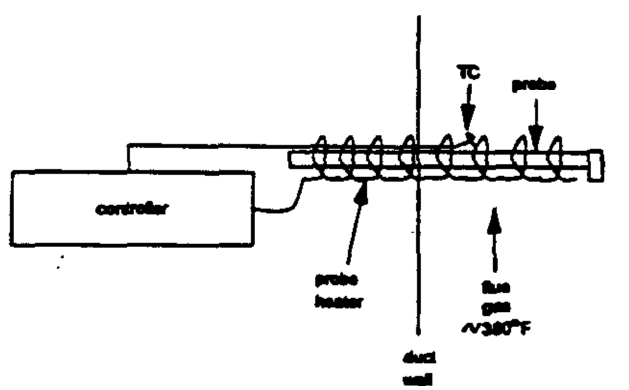

Figure 2. Thermocouple inside duct.

4. Finding: **The use of old absorbing solution in the Fyrite oxygen analyzers may have led to low oxygen results during the performance evaluation audit (PEA).** During the Fyrite oxygen analyzer PEA with analyzer set #1, the oxygen analyzer measured oxygen 24 percent low compared to RTI's standard gas cylinder. The second oxygen analyzer measured oxygen approximately 3 percent lower than RTI's oxygen standard. It was determined that the source of error may have been the use of old absorbing solution in the analyzer.

   Effect on Data: Even though Chester Environmental checked the Fyrite #1 periodically with ambient air, the oxygen analyzer continued to give erroneous results when challenged with a standard oxygen concentration. Checks of the Fyrite against a standard on a regular basis should be performed and the absorbing solution should be regularly replaced to prevent measuring incorrect oxygen concentrations at the flue gas sampling locations. Accurate oxygen measurements are necessary in determining the air in-leakage at the flue gas sampling locations for flue gas molecular weight calculations.

5. Finding: **The field balance used to weigh impinger solutions, drierite, etc., was not being calibrated using NIST-traceable weights.** Section 5.1.2.1, "Field Sampling Equipment," of the Sampling/Testing and QA/QC Plan states, "Field checks of balance accuracy will be made daily using a set of QC weights which have been weighed side-by-side with NIST-traceable weights."

   Effect on Data: This will have minimal effects on data because none of the weighings are used for analytical measurements. This balance was not used for weighing filters, impactor catch, or any other critical measurements.

6. Finding: **Water used for washing and making impinger solutions was a commercial brand of unknown chemical composition.**

   Effect on Data: The water should be carefully tested for the presence of any of the target analytes. If results show no contamination, or if background levels can be subtracted, there should be minimal impact on data.

7. Finding: **Glassware used by Battelle's subcontractor, Chester Environmental, for aldehyde analysis was of a different size than that used by Battelle.** Battelle used midget impingers, while Chester used full-size impingers.

   Effect on Data: Differences will probably be minimal, but without side-by-side comparison information, it would be impossible to be certain that the data are exactly comparable.

8. Finding: **There appeared to be some bleaching of the DNPH solution, particularly the second DNPH impinger, possibly due to the high levels of SO_2.**

Effect on Data: Unknown. See recommendations section for a suggested investigation.

9. Finding: **Baghouse ash may have been contaminated by the sampling device.** Battelle employed a painted steel tube within a tube device for sampling baghouse ash. Ash samples were obtained by inserting the device into the ash hopper, collecting the ash sample, and dispensing the collected sample into an amber jar. Auditors noticed a few spots where the black enamel paint had flaked off the tube and rusty metal was exposed.

Effect on Data: Sample contamination could result. The effect on the data is unknown, but trace metals analyses for these samples should be reviewed for any evidence of contamination.

10. Finding: **Sampling of the baghouse ash may not have been representative.** Baghouse ash was sampled from three of the six ash hoppers. This sampling configuration resulted from an obstructed sampling port for one of the ash hoppers.

Effect on Data: Battelle assumed that all six hopers held identical material and the sampling ash from three hoppers was a representative sample of baghouse ash. Each of the ash hoppers will contain identical material given that there is a uniform flow of flue gas through the compartment of the baghouse and a uniform distribution of particles in the flue gas.

Auditors observed a 90-degree elbow in the duct at the baghouse inlet. This sharp bend in the ductwork could cause some gas flow disturbances and result in uneven particle distribution. Since the velocity traverses are unable to be performed at this location, the discovery of any effects of this disturbance are pending laboratory analysis.

Observations

1. No grease was used with Battelle's sampling trains. Because train components had been preselected for good fit, leakage was held to a minimum. Chester appeared to use Teflon tape on some of the ground glass joints in their trains to minimize leakage.

2. The sampling ports that had been provided in the SNOX facility ducts were only about 2 inches in usable diameter. This limited the diameter of probes used and prevented in-stack use of larger devices such as cascade impactors and cyclones. Battelle and

Chester were well-prepared for most potential problems resulting from the small port openings; however, comparison of these data with those obtained at other sites may reveal differences due to extractive versus in-stack sampling.

3. Field personnel did not know if any single data base would be used to manage the analytical data. If a laboratory audit is performed, it would be a good idea to audit data transfers between the data bases.

Recommendations

1. The field balance should be checked daily with NIST-traceable weights. Checks should be recorded in the log book.

2. Water analyses, including reagent blanks for the impinger solutions made with the Magnetic Springs water, should be presented in the QC section of the final report.

3. The observed bleaching of DNPH solutions should be investigated. It is especially important to verify (1) that high levels of SO_2 or NO_x do not degrade the adducts after they are formed, and (2) that unreacted DNPH is not degraded to such an extent that there is incomplete capture of the aldehydes and ketones. Stack conditions could be recreated in the laboratory to investigate the reactivity of DNPH and adduct solutions with high SO_2 gas, high NO_x gas, and zero air.

4. A computer model should be run to estimate the amount of particulate material lost in the tubing between the sampling nozzle and the cyclones outside the stack. Results of size-fractionated chemical analysis should be corrected based on modeling results and probe and tubing wash data.

5. The all-glass cyclones fabricated by Battelle should be subject to validation testing since they are of a new design. Important considerations include accuracy of calculated cutpoints, presence of any static charge buildup on the nonconductive glass surfaces, and losses in the sample probe and flexible line leading from the duct to the cyclone.

6. Battelle should assure that Chester checks the Fyrite oxygen analysis against a standard on a regular basis and that the solutions are changed to appropriate intervals.

Activities

1. Performance Evaluation Audits (PEAs)

All scheduled PEAs were performed for the following:

- Paramagnetic oxygen sensors
- Fyrite oxygen analyzers
- Aldehydes
- Trace metals
- PAHs
- VOST
- Dry gas meter/standard orifice
- SO_2 and NO_x (ABB SNOX monitors)

The results of the paramagnetic oxygen sensor PEA, the Fyrite oxygen analyzer PEA, and the CEM PEA are shown in Tables 1 through 3. Chester Environmental's dry gas meter audit results were within 2 percent of the standard critical orifice measurements. Battelle's dry gas meter audit data had not been received as of August 2, 1993. Sandy Anderson, the QA Officer, was contacted concerning the missing information.

2. Technical Systems Audits (TSAs)

Because of plant operational problems, not all sampling trains were observed; however, all basic activities including traverses, glassware and train preparation, and recoveries were observed. Recovery of material from the cyclones was not observed because the auditors were not present on an inorganics test day. Some additional calibration data not present at the site were requested.

Personnel Present During Site Visit

Name	*Organization*	*Telephone*
Robert Evans	DOE	
George Sverdrup	Battelle	(614) 424-5014
Paul Webb	Battelle	(614) 424-5014
John Kelly	Battelle	(614) 424-3495
Debbie Smith	Battelle	(614) 424-4114
Joe Tabor	Battelle	
Raj Rangaraj	Battelle	
Sandy Anderson	Battelle	(614) 424-5220
John Hilborn	Ohio Edison	(216) 384-5768
Mark Grunebach	Chester Environmental	
Timothy Cassell	ABB	(216) 652-4881
Jim Flanagan	RTI	(919) 541-6417
Lori Pearce	RTI	(919) 541-7182

TABLE 1. PARAMAGNETIC OXYGEN SENSOR PEA RESULTS

	RTI (Audit Standard)	Battelle	% Difference*
Model 570A Serial No. X-48490			
Zero (pure N_2)	0.0	-0.2	---
O_2 (%)	9.21	9.10	-1.20
Model 580A Serial No. X-43454			
Zero (pure N_2)	0.0	0.0	---
O_2 (%)	9.21	9.00	-2.30

* Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

TABLE 2. FYRITE OXYGEN ANALYZER PEA RESULTS

	RTI (Audit Standard)	Chester Environmental	% Difference*
Set #1			
Zero (pure N_2)	0.0	0.0	—
O_2 (%)	9.21	7.00	-24.0
Set #2			
Zero (pure N_2)	0.0	0.0	—
O_2 (%)	9.21	8.95	-2.82

* Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

TABLE 3. SNOX CEM AUDIT RESULTS

	RTI (Audit Standard)	ABB	% Difference*
O_2 (%)	9.21	9.02	-2.10
SO_2 (ppm)	1549	1555	0.40
NO_x (ppm)	815	810.5	-0.55

* Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE
NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

to

U. S. Department of Energy
Pittsburgh Energy Technology Center

(Contract DE-AC22-93PC93251)

Prepared by

Sandra M. Anderson
Quality Assurance Officer
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INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

INTRODUCTION

This report summarizes the audit activities conducted on-site at Ohio Edison's Niles Station WSA-SNOX demonstration project and at Battelle Columbus Laboratories from the time period of July 19 through October 11, 1993. As Project Quality Assurance Officer (QAO), I observed field sampling and laboratory activities which were compared to descriptions provided in the Management Plan for 'Study of Toxic Emissions from a Coal-Fired Power Plant Demonstrating the ICCT WSA-SNOX Project and a Plant Utilizing an ESP/Wet FGD System' (DOE Contract DE-AC22-93PC93251) dated June 21, 1993, and the 'Final Niles QA/QC, Sampling, and Analytical Plans', dated July 17, 1993, under the same contract number.

During these observations, I recorded detailed notes which are summarized on the attached Checklists including general information (date, place, time, what, who), a brief narrative account, sample collection and related procedures, comments and recommendations. All of the recommendations were discussed in real-time with either the Project Manager, Assistant Project Manager, Field Sampling Manager, or Analysis Leader as soon as possible after the observation. Corrective action was implemented in most instances before the QAO left the inspection site or within a reasonable time length thereafter.

SUMMARY

Field and laboratory inspections conducted during Niles Station, SNOX Process Power Plant activities indicated that, for the most part, the QA/QC Plan of July 17 was being followed as written, or according to formal, written deviations as described in 'Technical Note, Volume 1 of 3 - Sampling' dated November 1993. These deviations were initiated either as a need for corrective action or because the technical and physical demands of field and laboratory operations precluded adhering to the original QA/QC Plan.

On-site field observations included: sample tracking, custody, storage, and shipping procedures; in-process sampling at Locations 20, SCR Reactor Outlet; 19, Baghouse Outlet; and 18, Baghouse Inlet. SNOX Process sampling was observed at Locations 1 (Boiler Feed Coal), 24 (Baghouse Ash), and 22 (Sulfuric Acid). Various sampling train recovery and preparation procedures were also observed.

The Battelle QAO also served as a point of contact, along with the Project Manager and Field Sampling Manager, for RTI personnel conducting an independent field audit on July 20-21, 1993. In the absence of the Field Sampling Manager, subsequent to the field sampling phase, the QAO provided the following to RTI Auditor L. Pearce: type S Pitot tubes calibration sheets dated July 13; completed Multimetals Train data sheets from sampling Location 19 (Run N-19-MUM-722) as requested by RTI's Jim Flanagan; nozzle calibration data forms dated 06/12/93 and 07/26/93, including one for Chester nozzle 54; and continuous instrument calibration data forms for Servomex 580A instrument (dated 07/24/93) and Servomex 570A instrument (dated 07/20/93). These are described in a letter to Ms. Pearce dated August 9, 1993.

Laboratory observations included: sample receipt, log-in, custody, and storage procedures; PAH/SVOC liquid samples extraction and concentration; systems audit of VOC-Canister sample receipt and analysis; anion analysis by ion chromatography and data tracking; PAH/SVOC liquid samples preparation; PAH/SVOC gas and liquid samples, filter preparation; PAH analysis by GC/MS and Dioxin/Furan analysis by GC/MS.

Following is a sequential account of Niles Station SNOX Process audit activities, each with a brief narrative and QAO's recommendations when applicable. For detailed records, dated observations recorded on either the Field Inspection Checklist or Laboratory Inspection Checklist should be consulted.

CHRONOLOGY

Sampling Day 02, 19 July 1993:

Observations: Process Sampling for Boiler Feed Coal at Location 1. Half-hour process samples were collected from each of the coal feeders with a painted, metal scoop into a cleaned coffee can and subsequently emptied into a plastic bag for compositing. Random-sized coal pieces are left in the sample collection. Impinger and train recovery procedures were observed for cyanide and multimetals, Location 19 baghouse outlet; and particulate filter recovery for Location 18, baghouse inlet. Impingers and trains arrived at the recovery sites on ice and connections were wrapped with tape when applicable. Rinsing, container, and collections procedures followed the QAP; Method 29 filter holder was brushed and wiped out, and reloaded for use at the same site location. Container labels and chain-of-custody forms were completed. Location 20, SCR reactor outlet, in-process sampling conducted by Chester staff, was observed as well as the sample preparation trailer used by the subcontractor team. Horizontal traverses as well as temperature and meter readings were noted.

Recommendations: Use of a painted scoop for boiler feed coal samples was discussed with the on-site Project Manager. Niles staff were requested to provide overnight sample custody for collected samples and to initial the last day's collection on the data form for traceability. Excursion from the QAP pg. 5.2-18 description of collecting into "precleaned glass bottles" must be addressed as a deviation. Sample custody and transfer must be clarified for times when samples are being transferred and the designated sample custodian is fulfilling sample collection obligations (three times daily samples for baghouse ash, Location 24). Individuals responsible for train recovery should also be clearly identified. Data sheets from sampling locations were observed with either no clock times for start/stop or names recorded were noted and this was discussed with the field sampling manager immediately.

Issues above were discussed during the second sampling day with Project Manager Sverdrup and Field Sampling Manager Tom Kelly. A formalized list of deviations was to be initiated and will be updated as needed, to describe departures from the QAP and the impact of the changes on the study.

Response: The deficiencies in documentation of data sheets, sample recovery, and sample custody were addressed immediately following the QAO's comments by directions and reminders to the pertinent staff in the field. The coal collection device caused no contamination of the coal samples, due to the large sample size collected and the lack of damage to the device itself. Use of plastic bottles has been noted as a deviation from plan in the Draft Final Reports on the Niles sampling.

Canceled Sampling Day, 20 July 1993:

Observations: Process sampling from baghouse ash Location 24 was observed early in the day. However, because of sampling program cancellation due to plant problems, this was the only process sample collected on this day. Time was dedicated to the accommodation of the RTI performance audit activities. This included oxygen meter checks with standard cylinders provided by RTI; spiking of XAD-2 traps and filters; initiation of dry gas meter audits for Locations 18 and 19, using an EPA standard orifice supplied by RTI. A detailed examination of the sample processing, custody, and shipping procedures was conducted by the Battelle QAO.

Recommendations: There was no standard calibration form available on site for either Battelle or the subcontractor on which to record results of the RTI audit. Discussed data entry correction procedure with the Field Sampling Manager to eliminate obliterations of corrected values on sampling data forms. Situation was discussed with the custodian and train recovery leader in which filters prepped after recovery late on 07/19 were properly stored and labelled but were not logged onto the chain-of-custody form by mid-day of July 20.

Response: Further discussions were held with field staff responsible for the sample documentation and custody. The minor lapses still found in these areas were due to the conditions of field work and the large numbers of samples being logged in.

Sampling Day 03, 21 July 1993:

Observations: RTI staff continued the conduct of their performance audit. The Battelle QAO reviewed sample packaging and shipping procedures. "Cold" samples such as impinger solutions, XAD-2 traps, VOCS and SVOCs are shipped out daily on ice via courier. Process coal and preserved samples are shipped back to labs at the conclusion of sampling. VOC SUMMA canisters are shipped out within 24 hours of collection. All sample container labels are covered with clear tape, the containers wrapped in bubble wrap and double plastic bags for shipment. Receipt and temporary storage of Chester VOST tubes were observed. Baghouse inlet sampling at Location 18 was initiated with a dry gas meter calibration ongoing while the sampling team was setting the probe in place for the first of 22 vertical traverse sampling points. The second sampler was setting up for a horizontal traverse. Baghouse outlet sampling at Location 19 included setting up of the Nutech Stack Sampler, a critical orifice check and set up of the aldehyde impinger on the lower platform. The vertical traverse probe was already set up for the first sampling point. Transfer of SUMMA canisters to Locations 18 and 19 with chain-of-custody forms and cross check of canister identification tags were noted (88-044, 89-005, 88-033). Sulfuric acid sampling at Location 22 by ABB staff was observed from the tank under the SNOX tower. The sample was collected into a precleaned and labelled amber glass bottle and constituted the daily sample. RTI's spiking of two aldehyde trains was noted.

Recommendations: There were no additional recommendations for sampling day 03 observations.

A verbal debriefing was conducted by RTI and included the following highlights: Battelle is using bottled DI water that does not meet method requirements for ASTM Type II water. Even though blanks are run, consideration should be given to using bottled ASTM water. There is concern over use of a painted metal scoop for the coal feeder Location 1 process samples. The oxygen analogue meter was noted to be out of specified calibration ranges. There are differences in the aldehyde train connections: Battelle uses dry connections and a different sized impingers than Chester, which uses Teflon tape on ground glass joint connections. Fyrite tubes Chester is using must have a once/day standards check for accuracy. Additional minor points included whether quartz or glass filters were used for dioxin sample collection since the QA Plan didn't specify, and a question as to how glass end caps for sampling trains were stored during sampling.

Response: Most of the items noted in the RTI debriefing have been addressed in the Draft Final Reports on the sampling studies conducted at the Niles-SNOX and Niles Boiler No. 2. In both reports, responses to the RTI comments are presented in Appendix B: Auditing. Quartz fiber filters were used for all sampling. Glass end caps were covered in aluminum foil or kept in plastic bags during sampling.

Sample Receipt and Log-in, July 29, 1993

Observations: Samples for N 5a MUM 727, N 4 MM5 728, N 13 PRL, and N 8 PRS samples were tracked from evening delivery to the Battelle lobby, transfer by the Laboratory Sample Custodian to the receipt and log-in area, to final storage locations prior to preparation and analysis. Three coolers and seven boxes of liquid, solid, and filter samples were cross-checked between container label information and completed chain-of-custody forms prior to being logged into the custodian's record book.

Recommendations: Several discrepancies from the sampling aspects of the QA/QC Plan were noted and discussed with the Custodian and the Field Sampling Manager. Certain of these are to be addressed as deviations to the QA/QC Plan; others for which subsequent data were completed to assure traceability of samples and completeness of the sampling record, should be addressed for future studies by more vigorous training of field staff prior to departure for the sampling site. QAP pg. 5.2-22 specifies 4-liter bottles for collection of samples from Locations 9, 10, and 13. 500-ml amber glass bottles of samples were received from these sites. Location 9 'river water' is referenced as 'makeup water' in the QAP. Sequential samples for N 13 PRL 729 and others were noted with identical labels for all four containers. Subset identifiers should be added for traceability for this type of replicate sampling, which is not spelled out in the QAP. Discrepancies in sampling times between the container labels and completed chain-of-custody forms varied from a few minutes to an hour. Certain sampling team members used only their first names on forms and labels. The

Laboratory Sample Custodian documented labelling and sample container discrepancies on both the custody form and the sample record logbook.

Response: As noted, some discrepancies were observed in documentation of samples. However, all such discrepancies were resolved in the chain-of-custody review process prior to sample analysis, and all samples were identified and accounted for. Improvements in the sample numbering scheme will be made in any future work. The collection of liquid samples is noted as a deviation from plan in the Draft Final Reports on the Niles sampling efforts.

PAH/SVOC Liquid Samples Extraction and Concentration, 04-05 August 1993

Observations: Method 3510 was followed for extraction, pH adjustment, spiking, and concentration. Spiking and surrogate solutions are traceable to neat stocks. Samples were labelled properly through the 2-day process and custody procedures observed through final transfer to the analyst. N 9 PRL 730 samples for pond water, river water, trip, and field blanks were tracked for this observation.

Recommendations: There were no recommendations for these observations.

VOC-Canister GC/MSD Analysis, 05 August 1993:

Observations: A system audit was conducted of VOC-canister analysis, from transfer to the analyst by the Lab Sample Custodian, instrument calibration with a 42-component NIST-traceable standard, sample analysis, data acquisition and review, and transfer to canisters for recleaning. VOC canisters are shipped within 24 hours of field collection and the analysis is initiated the next morning after sample receipt to maintain the holding time limitation of 2 days.

Recommendations: Clarification of using a 42-component, rather than the QAP p. 4.1-14 'containing the 41 target compounds' should be added to the study record. This is not technically a deviation, however.

Response: The cylinder used for calibration contained 42 compounds; however, for this study, only 41 compounds were targeted for analysis.

Ion Chromatography Analysis, 11 August 1993:

Observations: Process water samples from 728 are received in 40-ml amber vials and the labels checked to the chain-of-custody form copy. Twofold dilutions of samples are made using a calibrated autopipettor. Standard, calibration, and spiking solutions are traceable to a separate logbook. EPA Method 300.0, December 1989, is used as a guideline. EPA PE Standard WP029 is used as an accuracy check solution for Dionex instrumentation. Sample custody is documented from receipt through analysis. The analyst reviews generated data and sets up a data file for each set of samples that includes: Final Anion Report, Summary Report, Calibration Plots, Duplicate and Spike Data, Standards Prep Data, Analysis Conditions and Chromatograms.

Recommendations: Minor clerical traceability issues were discussed with the analyst. Reference to the specific method guidelines used and brief description of the sample preparations should be added to the study record book.

Response: Reference to specific method guidelines and a description of the sample preparation procedure were added to the study record book.

PAH/SVOC Gas and Liquid Filter Preparation, 20 August 1993:

Observations: N F 730 samples for Locations 5a, 5b, and 4 were observed from initial custody transfer, through column chromatography, extraction, spiking with internal standard, concentration, and storage until analysis. Chromatographic reagent preparation and glassware preparation were discussed with the analyst. Sample labels reflect identity throughout the process and tracking documentation is also described in the study record book.

Recommendations: Calibration of the storage refrigeration unit thermometer was suggested, as well as a lock on the freezer where sample extracts are stored. The latter suggestion was implemented within the next day or two and alleviated the problem of unassured sample custody after working hours caused by a faulty door lock in the laboratory area.

Response: The storage refrigeration unit thermometer was calibrated as suggested.

PAH Analysis by GC/MS, 20 August 1993

Observations: Tuning, calibration, and analysis of the first sample extract was observed. A Battelle Facility SOP describes the analysis using the Finnegan MAT TSQ GC/MS. The instrument logbook records the sample ID, file ID, and laboratory record book reference number. Freezer for instrument standards is monitored. Sample analysis flow begins with an instrument tuning run, standard, standard, sample, sample, sample, standard at end of the run. The Lab Analysis Manager determines when corrective action is needed and also performs the action. Third party review of data and spreadsheet is performed before transfer of data for reporting.

Recommendations: No recommendations were made for this observation.

Dioxin/Furan Analysis by GC/MS, 11 October 1993

Observations: Samples are stored in a monitored freezer from transfer through analysis. MM5 Site 5a filter was tracked as a filter extract from the prep logbook to the Mass Spec logbook. Sample custody and transfer is also documented in the Dioxin Lab sample logbook. Five point recalibration is performed initially for the dioxin analysis, with continuing calibrations being performed at periodic intervals. Calibration standards are made up by the Standards Custodian from commercially available standards, as are window mix and column performance checks. The MS logbook documents operating parameters, as well as file ID, Lab ID, sample ID for cross reference, injection volume and clock time of injection. Instrument used is VG Analytical HP5890A GC, and 11-250J computer which was last validated on 07/07/93, according to the facility SOP. Sample analysis flow begins with performance checks, calibration, decane blank, samples (including QC), and calibration point at the end of the run.

Recommendations: No recommendations were made for this observation.

FIELD INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 19 July 1993

STUDY NUMBER SO950714 SITE LOCATION Niles Station, Niles, Ohio

SNOX Process TIME 2P; 540P Day 02

STUDY PROTOCOL/QAPP QA/QC Plan DE-AC22-93PC93251

Field Phase Inspected Process Sampling Boiler Feed Coal Location #01

Personnel Involved Niles Staff - Fred

Protocol/QAPP/SOP Requirements QAP pg 5.2-~~27~~ 18 error 07/23/93 SMA 5.2-18, 19 (Process)

Narrative Account Half hour sample collected into pre-cleaned glass bottle per QAP p 5.2-18 changed to one scoopful of coal removed from each hopper into a coffee can. Random sized coal pieces are left in can. Samples collected every half hour when the sampling team is collecting only

Sample collection, containers, custody and transfer procedures SMA

Additional Comments Requested that last days entry be initialed by sampler for traceability. Site form will note any system shutdown. Painted metal scoop used to collect. Spls. will be emptied from coffee can into plastic bag for compositing.

Recommendations Process coal samples stored next to boiler. Rec. moving samples to more secure location & assure custody for overnight collection of samples ①

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① Excursion from QAP 'glass bottle' should be noted in deviations for site.

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FIELD INSPECTION CHECKLIST

AUDITOR S MAnderson DATE 19 July 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station Niles, Ohio

SNOX Process TIME 2P, 4P Day 2

STUDY PROTOCOL/QAPP QA/QC Plan Contract DE-AC22-93PC93251

Field Phase Inspected Cyanide Impinger Recovery Baghouse Outlet Location 18 19 Error in location SMA 07/23/93

Personnel Involved Raj Rangaraj

Protocol/QAPP/SOP Requirements QAPP 5.2-10, pg 5.2-42, 43; 5.3-7, 8

Narrative Account Observed impinger collection, rinse and transfer to labelled sample jars, weigh check, 7 impinger

Balance used = Mettler P1200 N, Calibration due 09/93

Sample collection, containers, custody and transfer procedures Spl. custodian is also collecting samples at this site. A designated back-up must be named to log in samples when she is unavailable.

Additional Comments Refrigerated samples to be left outside in cooler under trailer are to be brought inside for security until shipment to lab.

Recommendations No clock times recorded for sampling start/end time. Need to indicate approximate times on data sheet. "Completed by" on sample labels need to be

FLDLST.05/93 Auditor's Signature and Date Sandy M. Anderson 23 July 1993

filled out consistently by either Train Recovery Leader or sampling team recovery person

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FIELD INSPECTION CHECKLIST

AUDITOR Smandum DATE 19 July 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles Ohio

SNOX Process TIME 805P Day 02

STUDY PROTOCOL/QAPP DE AC 22-93 PC 93251 16 July 1993

Field Phase Inspected Method 29 Train Recovery, Baghouse Outlet, Location 19

Personnel Involved Joe Tehan

Protocol/QAPP/SOP Requirements QAP p5.2-17, 23-24, 28, 29, 30

Narrative Account Recovery of multimetals train. Train sinnes side arm wrapped c teflon tape. Train recovery procedures followed fig 5-14, p 5.2-30 QAP

Sample collection, containers, custody and transfer procedures Spl. labels for train components filled out as 'competed by' Joe Tehan. Bottles for recovery rinses are precleaned amber & have label already on them.

Additional Comments None

Recommendations None

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<u>FIELD INSPECTION CHECKLIST</u>

AUDITOR S.M.Anderson DATE 19 July 1993

STUDY NUMBER 8130214 SITE LOCATION Niles Station, Niles, Ohio

SNOX Process TIME 5P Dla 02

STUDY PROTOCOL/QAPP

Field Phase Inspected Particulate Filter Recovery, Baghouse Inlet, Location 18

Personnel Involved Joe Tabor

Protocol/QAPP/SOP Requirements QAP pg 5.2-9

Narrative Account Method 29 particulate filter transferred to labelled petri dish. Filter holder brushed and wiped out, reloaded and used again for same site location

Sample collection, containers, custody and transfer procedures Petri dish has sample label affixed by Joe and custody form completed

<u>Additional Comments</u> None

<u>Recommendations</u> None

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FIELD INSPECTION CHECKLIST

AUDITOR S.M. Anderson DATE 19, 20 July 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles, Ohio

SNOX Process TIME 2308 Day 02

STUDY PROTOCOL/QAPP DEAC22-93PC93251 16 July 1993

Field Phase Inspected MUM Method 29 Sampling Location 20

Personnel Involved SCP Leader Dittel) Chester Staff

Protocol/QAPP/SOP Requirements QAP pg 5.2-17

Narrative Account Observed in-process sampling and horizontal traverses. Train iced. Staff taking temp. & meter readings but talking c S. Kelly re: possible plugged filter. only one SMA 7/23/93

Sample collection, containers, custody and transfer procedures Checked trailer Chester is using for sampling prep. Is neat and well-organized. Reminded staff of importance in completing sampling data forms as work is done. (1)

Additional Comments Observed set-up on non-sampling day as Chester staff was working c sampling port valve modifications to accomodate probes. Are sampling 4/6 ports only.

Recommendations Field Spec. Leader & Chester staff to describe sampling difficulties & change in splg time on 07/19/93

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(1) MUM custody signed over to D. Smith.

P03B 7/28

FIELD INSPECTION CHECKLIST

AUDITOR S Manderson DATE 20 July 1993

STUDY NUMBER SCH30214 SITE LOCATION Niles Station, Niles, Ohio

Sack Process TIME 850A

STUDY PROTOCOL/QAPP OE-AC22-93PC93251 16 July 1993

Field Phase Inspected Baghouse Ash Sampling Location 24

Personnel Involved Debra Smith, RTI Observer

Protocol/QAPP/SOP Requirements QAPP p 5.2-18, 19

Narrative Account 1st of three daily ash samples collected using elevated hoist and ADB sampling tube. New bags installed 2-3 weeks ago. 07/20 was a cancelled sampling day. This was the only process spl. collected.

Sample collection, containers, custody and transfer procedures Spls. dumped from tube into clean, labelled glass jars transported in cardboard box to trailer where custody forms are completed.

Additional Comments None

Recommendations None

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8904 7.28

FIELD INSPECTION CHECKLIST

AUDITOR JMAnderson DATE 20 July 1993

STUDY NUMBER SCA30214 SITE LOCATION Niles Station, Niles Ohio

SNOX Process TIME 1030A

STUDY PROTOCOL/QAPP DE-AC22-93PC93251 16 July 1993

Field Phase Inspected Performance Audit RTI, CEM Calibration

Personnel Involved Paul Nubb, J. Pearce

Protocol/QAPP/SOP Requirements and RTI letter of 16 July 1993

Narrative Account Oxygen Meter Calibration Check

(Battelle XX8490, Servomex 570A); calibrated using

Battelle cylinder, Reading N_2 1700 psi

O_2 50 ppm

11:40A 570A NO_2=9.1 O_2 N_2 9.0 1580A = O_2=0.0 O_2 N_2 9.0 (vs RTI 9.2)

Sample collection, containers, custody and transfer procedures Not Applicable

Additional Comments None

Recommendations No calibration form was available on which to record results of calibration. Readouts must be retained on traceable data record form or book

FLDLST.05/93 Auditor's Signature and Date JMAnderson 23 July 1993

8505 0728

FIELD INSPECTION CHECKLIST

AUDITOR JMAnderson DATE 20 July 1993

STUDY NUMBER 93024 SITE LOCATION Niles Station, Niles, Ohio

SMX Process TIME: 12P, 1210P

STUDY PROTOCOL/QAPP DE-AC22-93PC 93251 16 July 1993

Field Phase Inspected Oxygen Indicator (Fyrite Set 01) Subcontractor

Personnel Involved Mark Grunebach, Chester; RTI Staff

Protocol/QAPP/SOP Requirements and RTI letter of 15 July 1993; p5.1-35

Narrative Account Fyrite #9 Calibration at 2X = 0.0, <0.0

RTI recommends using a certified standard to recheck Fyrite Set

Sample collection, containers, custody and transfer procedures Not applicable

Additional Comments Observed RTI of Henry doing XAD-2 spikes on 2X filters and traps using an RTI Performance Audit Solution

Recommendations Above in narrative

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FIELD INSPECTION CHECKLIST

AUDITOR S.M. Anderson DATE 20 July 1993; 21 July 1993

STUDY NUMBER SC9302A SITE LOCATION Niles Station, Niles, Ohio

SNOX Process TIME 1225 P

STUDY PROTOCOL/QAPP DE AC-22-93 PC 93251 16 July 1993

Field Phase Inspected Sample Processing and Custody

Personnel Involved Debra Smith

Protocol/QAPP/SOP Requirements QAPP pg 5.1-25 & 29

Narrative Account Labels and custody forms completed for 07/19 samples; Chester samples sent to Battelle for locations 20, 21, MUM on 07/19. Chester relinquishes custody to Deb Smith who then sends spls. to Battelle with original chain of custody forms.

Sample collection, containers, custody and transfer procedures Custody form (above) copied and provided to Chester. Original form will be received by Laboratory Sample Custodian in Columbus. Trailer well-supplied c labels and forms.

Additional Comments Reviewed Sampling Data sheets on 07/21/93. Source Sampling data sheets need to be recorded as completely and legibly as possible because traceability (Aldehydes, VOST, CN, Acid Gas, NH_4)

Recommendations See above and note that Corrections must not obliterate original entry. Use single line-thru process

contd on 21 July 93

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Issue noted 07/20. Filters prepped after recovery late on 07/19 were properly stored on drying but not logged onto the custody form by train recovery leader. Discussed w/ Tuber and Deb Smith.

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FIELD INSPECTION CHECKLIST

AUDITOR Sandy M Anderson DATE 21 July 1993 02

STUDY NUMBER SC930214 SITE LOCATION Niles Station Niles Ohio

SNOX Process TIME 2:15 P day 03

STUDY PROTOCOL/QAPP DE AC-22-93 PC 93251. 16 July 1993

Field Phase Inspected Sample Processing and Custody Cont'd

Personnel Involved Debra Smith

Protocol/QAPP/SOP Requirements QAP pg 5.1-25 & 29

Narrative Account Chain of custody records review & processing: ambient temperature samples retained inside trailer and shipped back to Battelle at end of study. "Cold" samples are shipped out daily on ice via courier. Process coal and H_2SO_4 samples①

Sample collection, containers, custody and transfer procedures VOST samples are Chester staff's responsibility. We store their VOST tubes in our refrig only; retain C of C copies after spls. are relinquished to Chester for analysis

Additional Comments ① are also shipped back at the end of the study. Filter spls. for MM5 are shipped out on dry ice. All spl. container labels are covered c clear tape, wrapped in bubble wrap, 2X

Recommendations plastic bags then shipped on ice.

Battelle needs to design a calibration form for O_2 and other analyzers. Should fit generic use but still

FLDLST.05/93 Auditor's Signature and Date Sandy M Anderson 23 July 1993

serve as a prompt for user to complete information. Discussed c Tom Kelly.

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FIELD INSPECTION CHECKLIST

AUDITOR Madison DATE 01 July 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles, Ohio

SNOX Process TIME 740A day 03

STUDY PROTOCOL/QAPP QA/QC Plan DE-AC22-93PC93251 07-16-93

Field Phase Inspected Baghouse Inlet Sampling Location 18

Personnel Involved Paul Webb, Kent

Protocol/QAPP/SOP Requirements QAP p 5.2-10

Narrative Account Dry Gas Meter calibration at location while setting probe for vertical traverse. Collecting 22 valid sampling points on the vertical. Points on probe marked with tape. Second sampler was setting up for horizontal traverse.

Sample collection, containers, custody and transfer procedures

Additional Comments Particulate field data forms - reminded sampling team to complete as much information as possible before transferring these forms to the sample custodian

Recommendations

FLDLST.05/93 Auditor's Signature and Date Judy Madison 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR [illegible signature] DATE 10mov 23 July 1993

STUDY NUMBER 5C430214 SITE LOCATION Niles Station, Niles, Ohio

SHOY PROCESS TIME 930A day 03

STUDY PROTOCOL/QAPP QA/QA Plan: DE-AC22-93PC93251 07.16.93

Field Phase Inspected Baghouse Outlet Sampling Location 19

Personnel Involved Harry Leonard

Protocol/QAPP/SOP Requirements QAP 5.2-17

Narrative Account Nutech Stack Sampler undergoing a Critical Orifice Check. Observed aldehyde impinger train being set up on lower platform. Vertical traverse probe already set up for first sampling point. Distances marked on probe.

Sample collection, containers, custody and transfer procedures In-process sampling not yet initiated.

Additional Comments Harry had discussion c Jim Flanagan re probe temp ≥ 250°±25 requirement in method for last two sampling points. Harry will do a single run to provide gas temp. & verify no significant heat loss.

Recommendations None

FLDLST.05/93 Auditor's Signature and Date [illegible signature] M. Arduino 23 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR J. Madsen DATE 21 July 1993

STUDY NUMBER SCI3024 SITE LOCATION Niles Station, Niles Ohio

SNOX Process TIME 12 noon day 03

STUDY PROTOCOL/QAPP QA/QC Plan DE AC22-93PC93251 07.16.93

Field Phase Inspected Summa Canister transfer to locations 18, 19

Personnel Involved Paul Webb, Gerry Leonard

Protocol/QAPP/SOP Requirements QAPP p 5.2-39

Narrative Account Summa canisters were taken to base of each sampling platform with chain of custody samples for each. Cross-checked tag numbers on cannisters.

Sample collection, containers, custody and transfer procedures Battelle X numbers for these summa canisters: 88-044

89-005

88-039

Additional Comments None

Recommendations None

FLDLST.05/93 Auditor's Signature and Date Judy Madsen 21 July 1993

FIELD INSPECTION CHECKLIST

AUDITOR: J M Anderson DATE: 21 July 1993

STUDY NUMBER: 21302/14 SITE LOCATION: Niles Station, Niles, Ohio

TIME: ~130 P day 03

STUDY PROTOCOL/QAPP: QA/QC Plan TE AC22-93PC93251 Dated 16 July 1993

Field Phase Inspected: Sulfuric Acid Sampling, Section 22

Personnel Involved: ABB Staff

Protocol/QAPP/SOP Requirements: QAP p5.2-19

Narrative Account: Observed sample collection from tank under SNOX tower. Sample collected into precleaned amber glass bottle. This constitutes daily sample for this process.

Sample collection, containers, custody and transfer procedures: None

Additional Comments: None

Recommendations: None

FLDLST.05/93 Auditor's Signature and Date: Shirley M. Anderson 23 July 1993

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LAB INSPECTION CHECKLIST

AUDITOR Sandy M. Anderson DATE 29 July 1993

STUDY NUMBER SG30214 SITE LOCATION Niles Station, Niles, Ohio

→ Battelle Room 6028 TIME 603P to 8P

STUDY PROTOCOL/QAPP QA/QC Plan DE AC 22-93PC 93251 07.16.93

Lab Phase Inspected Sample Receipt and Log-In

Personnel Involved Sue Champagne, Jan Satola

Protocol/QAPP/SOP Requirements QAP pg 5.1-29-32

Narrative Account Samples picked up in lobby at 603P and transferred to room 6028 (locked), included three coolers and seven boxes. LRB 46757 was used to record receipt. Included Bulk spls, MM5, MUM location 5A. Chain of custody form & samples reconciled by (Sue &) Jan and Sue verified

~~Sample storage, preparation, analysis and custody procedures~~ labels on bottles. Most bottle caps are unlabelled. Tracked N5A MUM727 spls. to QAP pg 5.2-30 diagram. All spls. accounted for. 07/28 N4 MM5 impingers, probe rinse, cyclones

~~Additional Comments~~ and PRI-13 # 9,10,13 checked. All bags and bubble wrap protecting samples were carefully split with a (safe) knife. Pond and river water samples in quart amber bottles as well as Coal Run-off. ①

Recommendations QAPP pg 5.2-22 specifies 4-liter glass bottles for #9, 10 and 13 samples. Change to quart amber bottles must be addressed Contd to 24 July 02

LABLST.05/93 Auditor's Signature and Date 30 July 093 Sandy M Anderson

① # 9 location called River Water on labels is referred to as Makeup Water, QAP pg 5.2-22

LAB INSPECTION CHECKLIST

AUDITOR Sandy M. Andersen DATE 29 July 1993-02 contd.

STUDY NUMBER SC93624 SITE LOCATION Niles Station, Niles Ohio

TIME

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account N4-MM5-0728 trap samples were immediately transferred to Revco freezer (GI93219) in Room 6031. N-13-PRL-0729 has single entry of "no pH adj. pH already <2"; filter spl. N4MM5 07-28 and filter MUM5A (and 5B) 0727 tracked to COC forms.

Sample storage, preparation, analysis and custody procedures Aldehyde N4ALD0728, 40 ml amber imp 1,2,3 (Red ID on lids) transferred to monitored refrig (I85283) in room #6028. N4MM5 filters #1 and #2 0728 ESP Inlet transferred to freezer.

Additional Comments Four liter spls 9 and 10 for 0726 and 0728 placed in refrigerator. All samples received at GP were properly transferred and stored. MUM and CN spls were transferred to Rm 7028 cold (40°F) storage

SMA Recommendations facility which is locked. Custody form originals are sorted by sample ID, put into binder and pages numbered consecutively. Originals remain

LABLST.05/93 Auditor's Signature and Date Sandy M. Andersen 30 July 1993

with custodian, copies go to analyst and technicians preparing spls. Initial pH and temp recorded >5 hours where required. All sample processing begins < 7 da holding time.

Contd. 29 July 02

LAB INSPECTION CHECKLIST

AUDITOR Lindy M. Anderson DATE 29 July 1993-03 Cont'd.

STUDY NUMBER SC93024 SITE LOCATION Niles Station Niles, Ohio

→ Battelle Room 6028 TIME 6-8 P

STUDY PROTOCOL/QAPP QA/QC Plan IE AC22-93 PC 93251 07.16.93

Lab Phase Inspected Sample receipt, custody, transfer, storage

Personnel Involved Sue Champagne, Jan Satola

Protocol/QAPP/SOP Requirements QAP pg. 5.1-27, 28

Narrative Account Recommendations from here to bottom of page:

① N.13. PRL.0729 have four bottles with identical sample ids. Sequential samples must have sub-ID for traceability

② PRL sample in 40 ml vials for location 9 on 07/29 have identical IDs for 500 ml amber bottles. Need to differentiate

~~Sample storage, preparation, analysis and custody procedures~~ for traceability and analyses ③ See recommendation re quart amber bottles rather than 4L amber on pg 01; ④ label/COC discrepancies follow: a. N8 PRS 728 from hoppers read "1700 hrs" on

~~Additional Comments~~ label and "1600 hrs" on COC; b. 07.28 air heater ash from #3 is called "economizer ash" on labels

Spl 2-3 times	11:45 label	11:30 COC
	14:20 label	14:30 COC
	16:50 label	17:00 COC
2-4 times	11:25 label	11:30 COC
	14:45 label	1430 COC
	17:30 label	1700 COC

Recommendations

Coal sample N.1. PRS. 727 2 bag for 07.27.93 no time recorded

LABLST.05/93 Auditor's Signature and Date Lindy M Anderson 30 July 1993.

→ All of above issues were relayed to the Field Sampling Manager by phone on 30 July 1993 by the QAO.

PS15 7 28

LAB INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 04 August 1993

STUDY NUMBER SC930214 SITE LOCATION Niles Station, Niles Ohio

→ Battelle Room 7243 TIME 740A

STUDY PROTOCOL/QAPP DE AC 22-93 PC 93251 07.16.93

Lab Phase Inspected PH/SVOC - Liquid Samples Extraction

Personnel Involved Sue Chiapazzo

Protocol/QAPP/SOP Requirements QAP 53-17-18

Narrative Account Method #3510 - Extraction Method - Separatory funnels all labelled 46707-9-XX. pH adjusted to <2. One liter samples, amber round bottles brought up from cold storage. QC samples prepared: MS, MSD (Pond) Duplicate (River Water), H_2O Blank

Sample storage, preparation, analysis and custody procedures Tracked N.9.PRL.730 Pond water, River Water, Trip Blank, Field Blank to lab and chain-of-custody forms

Additional Comments Added 1.0 ml Surrogate Spike [(46399-77-05), labelled c name, date, storage temp]; Added 1.0 ml Spiking Standard (46399-77-20), add $MeCl_2$, shake two minutes. Hood monitored (X 92122) 04/13/93

Recommendations "Chad C." as sampler on C-of-C form insufficient for traceability. Discussed earlier c Tom Kelly. Called lab safety re. updated hood monitoring.

LABLST.05/93 Auditor's Signature and Date Andy M Anderson 05 August 1993

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[illegible] 11.15.93

LAB INSPECTION CHECKLIST

AUDITOR S Manderson DATE 05 August 1993

STUDY NUMBER 9CC30203 SITE LOCATION Coal Creek / Niles Power Plants

TIME 10A

STUDY PROTOCOL/QAPP DE AC 22-93PC93251, dated 21 June 1993

Lab Phase Inspected VOC - Canister Analysis GC/MS Systems Audit

Personnel Involved William Keigley

Protocol/QAPP/SOP Requirements QAPP p A-3-6, 7; A.2-3; A.1-31

Narrative Account Canisters checked for vacuum & pressurized to zero upon receipt (9-12 A [illegible] of spl. [illegible]) of samples from Outsiders; GC/MS is calibrated c a 42-Component mix traceable to NIST benzene std. (LL17305 - calib std). 42-comp. mix is injected into facility smog chamber, analyzed and ①

Sample storage, preparation, analysis and custody procedures Sample custodian delivers canisters after receipt + log-in to Bill Keigley who logs them into a facility spl. log book. Also has copy of orig. C-of-C forms, indicating trip spike(s) Trip blank.

Additional Comments ①contd. quantitated. Std. quantitation analysis report is placed into G285 study record book for traceability from original mixing by G. Keigley. Data is acquired on an HP5880 GC/FID with HP5970 MSD. HP computer system is

Recommendations HP Chemstation. Uses canister ID and Sample IDs as cross reference in logbook. Hard copy output transferred to M. Holden, as well as tape, which is retained for study duration.

LABLST.05/93 Auditor's Signature and Date Sandy Manderson 05 Aug. 1993

Analyst checks data & performs reviews as: Calibration, samples. All data is retained. Ea samples data file includes: C-of-C copy, run log, hard copy output. Files run by daily sequence. After spls. are run, VOC canisters are transferred to Richard Smith for cleaning.

17 ①
VS 16 of 28

LAB INSPECTION CHECKLIST

AUDITOR J M Anderson DATE 05 August 1993

STUDY NUMBER SA302/4 SITE LOCATION Niles Station, Niles, Ohio

→ Battelle Rm 7331 TIME 130P, 325P

STUDY PROTOCOL/QAPP QA/QC Plan DE-AC22-93PC93251 Dated 16 July 1993

Lab Phase Inspected PAH/SVOC - Liquid Samples Concentration

Personnel Involved Sue Champagne

Protocol/QAPP/SOP Requirements QAP Pg 5.3-17

Narrative Account Concentrating samples (Kuderna-Danish) in Blue M Heated Water Bath; Mell's Actuant combined acid/base. Thermometer measures water temperature at 65°, 70°. Concentrates to <1.0 ml → GC vial → Analyst for storage and analysis at JN-4 facility (Battelle).

Sample storage, preparation, analysis and custody procedures Spl. 46707-09-04 K-D flask + receiver ampul labelled c Sample ID. C-of-C original form remains c sample custodian. Samples are kept under locked custody.

Additional Comments Micro-Snyder concentrations <1.0 ml are transferred to Wheaton Glass vials with teflon-faced silicon septa. Vials are labelled and labels covered with clear tape, teflon tape wrapped. Spls: extracts

~~Recommendations~~ not stored in X42319 freezer, Rm 7245

Tracked 46707-09-05 Pond Water

N.Q.PRL-730-04 River Water N.Q.PRL-730-06 Field Blank

N.Q.PRL-730-05 Trip Blank 46707-24-10 Water Blank

LABLST.05/93 Auditor's Signature and Date Sandy M Anderson 06 August 1993

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LAB INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 11 August 1993

STUDY NUMBER SE93021A SITE LOCATION Niles Station, Niles Ohio → Rm 7343 TIME 830A

STUDY PROTOCOL/QAPP DE AC22-93 PC 93251 07.16.93

Lab Phase Inspected Anion Analysis - Ion Chromatography

Personnel Involved Dave Vermillion

Protocol/QAPP/SOP Requirements QAP pg. 5.3-8, 9; 5.1-16, 17

Narrative Account Sample storage at 5°C # 686-031 VWR, monitored on workdays; locked during off-duty hours. WPs - accuracy check serve as Performance Evaluations on WP spls → (Cl, F, SO4) EPA → verified by EPA → PE reports sent by EPA 2X/year; ICVs precision standards made from stock solutions

Sample storage, preparation, analysis and custody procedures ICh # assigned by Dave, cross reference to original chain of custody record and spl. description. Dave receives spls. and C-of-C copies and also signs original form. Sample Status Sheet verified regularly

Additional Comments Raw data acquired → analyzed → reported. Separate Duplicates and Spikes Sheet. ② Standards and Calibrations lab pg 2. Bulk stds have exp. dates, Sept 6 months. Phosphate made up fresh for

SMA ~~Recommendations~~ ea. batch. ③ Analysis Conditions describe column and eluents ④ Chromatograms are final output. File sent for QC Review includes: Final Anion Report,

LABLST.05/93 Auditor's Signature and Date Sandy M. Anderson 11 August 1993

Summary Report, Calibration Plots, Duplicate and Spike Data, Standards Prep. Data, Analysis Conditions, Chromatograms.

Cont'd. 11 Aug-93
SS 19728

LAB INSPECTION CHECKLIST

AUDITOR SMAnderson DATE 11 August 1993 - 02 Contd

STUDY NUMBER SC193024 SITE LOCATION Niles Station, Niles, Ohio

TIME 10:10A

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account 40 ml amber vial label checked to custody record after removal from locked refrig. Spl aliquot removed to Dionex vial. Analyst wears gloves for handling of samples. Vials marked c spl. ID and dilution. (4) of 4.95 ml DI H_2O and 50 µl spl. c 50 µl Gilson autopipette. Rinse pipet c "house" DI

Sample storage, preparation, analysis and custody procedures PRL (process waters) 1335-36, 1341-46 from 1728; 1345: spl, duplicate, and spike (0.2 ppm of ea analyte); 1:100 spl. dilution used. ~~Equip~~ error SMA 8/11/93

Additional Comments Equipment: Gilson Autopipette # C 480039, calib. before each use. Mettler AE160 # A61210, calib. due 09/93; weight set S/N 5386, calib. due Jan. 1994. Dionex # 13790; Balance record book use. Calibration record (4)

~~Recommendations~~ SMA (1) DI water, also used as blank, plastic pipet and plastic Erlenmeyer. DI H_2O put into flasks fresh ea day. Spl. dilutions performed directly into Dionex vials. Contd-03

LABLST.05/93 Auditor's Signature and Date Sandy M Anderson 11 August 1993

(4) contd. and weight certificates. Pipette calibration - weighs 50 µl H_2O into plastic beaker. Weights were: 0.050, 0.051 and 0.051 mg.

LAB INSPECTION CHECKLIST

AUDITOR S Mandeson DATE 11 August 1993-03 Contd.

STUDY NUMBER SC 930214 SITE LOCATION Niles Station Niles, Ohio

TIME

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements QAP p 5.1-45

Narrative Account (B) Secondary dilution 4.5ml H_2O and 0.5ml of (A) from pg 02 this report. Uses point to point dln. pipet for ea one of duplicate set and all sples uses calibrated Gilson for 1:100 spl. dilution. Spl. vials are not mixed before aliquotting as analyst is looking for soluble materials only.

~~Sample storage, preparation, analysis and custody procedures~~ Stock anion std. used for spike; sples. capped c cap having built-in filter & mixed. Uses 5000 µl Gilson autopipette (calibrated) for H_2O. Stds. stored in same refrig as sples. 10 µl ea std spike used for 30 µl

Additional Comments total spike in 5.0 ml spl. Spiking c 100 ppm F^-, Cl^- and $SO_4^=$. Caps tightened, diluted & spiked sples mixed. Lab pg 22, 23 describes prep. Working stds. in volumetric flasks made from stocks described

SM ~~Recommendations~~ in study records. EPA Method 300 followed. First blank = refrigerated water blank → diluent blanks, rinse vials. Acquires data according to run schedule

LABLST.05/93 Auditor's Signature and Date Sandy Mandeum 12 August 1993

made up < analysis starts Contd. 11 Aug. 04

Standards and first blank loaded into autosampler. Analyst checks standards analysis as generated to check if all elements are < ref limits.

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LAB INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 11 August 1993 - 04 Cont'd

STUDY NUMBER 5493214 SITE LOCATION Niles Station Niles, Ohio

TIME

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account Routine Maintenance ① clean cell + conduct. cell. Calib Std. 2X year or when analyst determines need ② column change recorded. Conductivity Cell Calibration Standard = 1 mM KCl made up 1X year. Non-routine maintenance recorded in logbook. Dave has copy of ③ Work Plan

SMA ~~Sample storage, preparation, analysis and custody procedures~~ ② EPA Method 300.0, December 1989, pgs 01-04 Test Method for Detmn of Inorganic Anions in Water by Ion Chromatography. PE Std WP029 from EPA EMSL - uses 100µl inj. volume. Method calls for

Additional Comments 10% QC spls Recommended to Dave that spiking proces. for matrix samples be performed. Data can be qualified in the Analytical report as 'not reported,' 'saturated' etc. Peak Pro Version 2.1

Recommendations ① Add instrument ID spec. to record book ② Date and initial 'Final Anion Report' for traceability ③ Attach (tape) balance certificates in logbook

LABLST.05/93 Auditor's Signature and Date Sandy M Anderson 12 August 1993

④ Add requirement to use of EPA 300, Dec 1989, as guidelines
⑤ Add brief description of spl. prep to record book.

LAB INSPECTION CHECKLIST

AUDITOR S.Manderson DATE 20 August 1993

STUDY NUMBER SY30214 SITE LOCATION Niles Station, Niles, Ohio

→ Battelle Room 6004 TIME 930A

STUDY PROTOCOL/QAPP DE-AC22-93PC93251 07/16/93

Lab Phase Inspected PAH/SVOC Solid and Liquid Samples - Filters

Personnel Involved Dave Davis, Jan Satola

Protocol/QAPP/SOP Requirements QAP pg 5.3-13 to 16

Narrative Account Chromatography: deactivated silica gel - muffled 8 hr at 451°C - done fresh batch/day and approximately 10 g weighed onto a column; Glassware cleaning (Micro 8%) dilute acid, muffled afterwards; DI H_2O used for cleaning. Silica gel columns are wet-packed

Sample storage, preparation, analysis and custody procedures Irb-96688 used for PAH/SVOC tracking. Sample set 07-30 tracked. Sample code ID used as ~~staff~~ cross-reference. Dave Ogden extracts (ID #) → Dave O / Dave Harris (new ID#) Chromaseep vials

Additional Comments Freezer - monitoring 1X/week (SN 971623) Preliminary study for fractionation determined volumes used and details for solvents using a validated procedure. contd 20 Aug 03

Recommendations Recommend calibrating freezer thermom.; loose bottles into secondary containers to prevent possible breakage; padlocking freezer during non-working hours since laboratory is not locked.

LABLST.05/93 Auditor's Signature and Date Sandy Manderson 23 August 1993

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LAB INSPECTION CHECKLIST

AUDITOR S Manden DATE 20 August 1993-02 Contd

STUDY NUMBER SCl9102/4 SITE LOCATION Niles Station, Niles, Ohio

TIME

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account Concentration vials stoppered, covered with teflon tape, labelled with sample ID, lab # date of prep, temperature/storage → Silica column is labelled with Sample site ID → vials labelled with lab and spl. ID. Caps have teflon liners and are muffled (8 hrs/450°) <use.

~~Sample storage, preparation, analysis and custody procedures~~ Spl. loaded onto column → vial rinsed with hexane (1st wash discarded after packing column) → elution with MeCl2/hexane → amber bottles labelled with lab, spl. ID, type of fraction. Dilute fractions

Additional Comments are stored in hood at rt. until next step (Saturday). Spl. set ~~468~~ Run 4668-43-8 thru 43-14; Niles 5B-F-730, A, 5A, 5B are spl. IDs Contd 20 Aug

Muffle oven - Blum CN 7880F; S/N CW565; hood X96526

Recommendations Extraction hood last monitored 04/15/93 - called safety re: monitoring face velocity in 6004 to determine hood efficiency

LABLST.05/93 Auditor's Signature and Date Sandy M Anden 23 August 1993

LAB INSPECTION CHECKLIST

AUDITOR S Manderson DATE 20 August 1993-03 Contd

STUDY NUMBER SC93212/4 SITE LOCATION Niles Station Niles Ohio

→ Room 6004, 6031 TIME 11A, 20 August 1993-0

STUDY PROTOCOL/QAPP (spls were initiated for prep on 19 Aug. 1993)

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account Sample concentration - Dave removes label from amber bottle, transfers to KD set-up. 2-3X rinse c mell. Add boiling chips. Wrap macro-snyder c foil, short rinse c mell.

Sample storage, preparation, analysis and custody procedures Cyclone sample transfer from Dave Ozler / Melinda Hayes to Dave Daniel - documented in 46688 for log-in then stored in freezer until fractionation initiated; transfer also documented in D. Ozlers prep lab

Additional Comments Concentrated sample transferred to Chromaflex tube → spiked with internal standard then reduced c N_2 evaporator. Concentrated DCM fraction first then MeOH fraction. Blue M water bath 65° → 80° → 90°C

STM ~~Recommendations~~ All glassware + boiling chips muffled; recleaned and remuffled afterwards c clean glassware only. MM5 samples from lab 46688 p 92

LABLST.05/93 Auditor's Signature and Date Sandy Manderson 23 Aug 1993

LAB INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 20 August 1993 - A

STUDY NUMBER SC93.214 SITE LOCATION Niles Station, Niles, Ohio → Battelle TIME 330P

STUDY PROTOCOL/QAPP DE-AC22-93PC93251 07.16.93

Lab Phase Inspected PAH Analysis GC/MS

Personnel Involved Jane Chuang, Joe Tabor

Protocol/QAPP/SOP Requirements QAP P 5.1-19

Narrative Account FC-43 cell used for tuning filled ~1X/year. Calibration output record maintained. Two standards are run at beginning of day, every 3rd injection = std, and one run at end of day; FC-43 peak-fit run at beginning of each day.

Sample storage, preparation, analysis and custody procedures "TSQ" logbook has: sample ID, file ID, lab reference number. File ID tracks to Instrument Run Log, then file → Tape for data storage

Additional Comments Freezer for stds (S/N X7386 4074) monitored every other day. Syringes are cleaned c̄ toluene aspiration between each use. Spl. analysis → J Tabor check IS peak → SOP = CHEM III-0A6; Equipment Finnegan MAT TSQ GC/MS

Recommendations → Jane QCs + generates Direct Report → Y. Katona puts into spreadsheet → 3rd party QC review

Corrective Action: Joe → Jane who checks peak resolution, decides ① -

LABLST.05/93 Auditor's Signature and Date Sandy M Anderson 20 August 1993

Run flow: FC43 → std → std → spl. → spl. → spl. → stds
① to replace septum, break off front of column or to dilute the sample.

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LAB INSPECTION CHECKLIST

AUDITOR S M Anderson DATE 11 October 1993

STUDY NUMBER SC130214 SITE LOCATION Niles Station, Niles, Ohio

→ Battelle Rm 7249, 7228 TIME 210P

STUDY PROTOCOL/QAPP DE-AC22-93 PC93251 07.16.93

Lab Phase Inspected Dioxin/Furan Analysis GC/MS

Personnel Involved Mary Schrock

Protocol/QAPP/SOP Requirements QAP p5.1-20, 21

Narrative Account: Spl. stored in freezer S/N 386-024 (Rm 7249); MS Log 46575 p83 for Inst VG analytical HP5890A GC; 11-250J; Spl. removed from freezer, vortexed briefly then injected c separate spl. syringe. MS log has spl. file ID, GC/MS operating parameters; column is as specified ①

Sample storage, preparation, analysis and custody procedures Tracked spl. 46715-16-15, MMS Lite SA filter extract to MS logbook 46575 p83. Spl. custody transfer documented in Dioxin Lab Sample Logbook

Additional Comments ① in QAP p5.1-21. Five point recalibration performed on 10/07/93 (on MS log p.81). CONCAL is calibration point 03. Commercially available stds. (Cambridge Isotope) used. Dave Ogden is original standards custodian. Cont. 11 Oct 0.

Recommendations Checked c Mary & Karen Riggs re QAP p5.1-49 which implies that method blank will serve as lab and analysis blank. Clarified that method blank/spl. set is analyzed.

LABLST.05/93 Auditor's Signature and Date Sandy M. Anderson 11 October 1993

LAB INSPECTION CHECKLIST

AUDITOR S Andrews DATE 11 October 1993 - 02 Until

STUDY NUMBER SC93024 SITE LOCATION Niles Station, Niles, Ohio

TIME

STUDY PROTOCOL/QAPP

Lab Phase Inspected

Personnel Involved

Protocol/QAPP/SOP Requirements

Narrative Account Spl. flow = window mix and column performance check (both commercially purchased), run as a single injection → calibration point 03 → decane blank → spls. as method blank (once/set), sample, matrix spike, spl. Cal. pt. 03 run at beginning and end of day

Sample storage, preparation, analysis and custody procedures MS log: MS file ID, lab ID, spl. ID for used sequence, injection volume, and clock time for injection; Cal. Standards window & perf. mix stored in monitored, locked freezer (I-75025)

Additional Comments M. Shrock and J. Talor performing dioxin analyses. Joe does integrations (data analysis) and Mary enters data into spreadsheets which are transferred to Assistant Project Manager for final review

Recommendations To SEQ Computer validation performed 03/01/93, 07/07/93 (by M. Shrock) and both passed

LABLST.05/93 Auditor's Signature and Date Sandy M. Andrews 11 October 1993

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APPENDIX C

SAMPLING PROTOCOL

SAMPLING PROTOCOL

C-1. Introduction

The purpose of this Appendix is to summarize important aspects of the field sampling effort at the SNOX process that may not be adequately covered elsewhere. The actual schedules and sample recoveries achieved in the field are described in sections 1 through 3 of this report. This Appendix provides further detail on the procedures used in sampling, recovering, and storing samples from flue gas, solid, and liquid streams. This information is intended to supplement that provided in the QAPP for this project.

C-2. Reagent and Materials Preparation

The sampling conducted at SNOX process required a variety of chemical reagents and sampling materials, which were prepared or provided either by Battelle or by Battelle's subcontractors. All of the chemical reagents needed for flue gas sampling and sample treatment were prepared by Battelle, and distributed to Chester Environmental sampling personnel as needed. The purpose of this approach was to minimize sampling variance by using reagents from a single source. The list of reagents included acidified peroxide and permanganate for the Multi-Metals trains, carbonate/bicarbonate solution for the anion trains (Method 26A), 0.1 N H_2SO_4 for ammonia collection, 0.1 M NaOH for cyanide collection, and acidified 2,4-dinitrophenylhydrazine (DNPH) for aldehyde collection. These reagents were made up on-site from high purity starting materials, including deionized water, or were prepared from concentrated stock solutions brought from Battelle, when reagent stability made that approach appropriate. All reagent solutions were made up fresh on the day of sampling and distributed to Chester personnel.

Various rinse solutions were also brought to the site or made up by Battelle, for use in recovering samples from the various trains. Those brought to the site were deionized water, acetone, acetonitrile, and 50/50 methanol/methylene chloride. Rinse solutions made up at the site were 0.1 N HNO_3 and 8 N HCl. These solutions were supplied to Chester staff as needed.

Sampling materials were provided both by Battelle and by subcontractors. Materials provided by Battelle were Summa polished sampling canisters for VOC's, filters for all flue gas sampling runs except the HEST, and cleaned XAD resin for all SVOC sampling by Modified Method 5. The XAD was obtained and cleaned by Battelle, and was used to fill sampling glassware of different designs for Battelle and Chester. The filters provided by Battelle included 87 mm diameter for Battelle's flue gas sampling, 104 mm diameter for Chester's hot flue gas sampling, and 203 mm x 254 mm (8 in. x 10 in.) for Chester's PSDS sampling. All these filters were high purity quartz fiber. Filters used for SVOC sampling were muffled and stored in muffled aluminum foil before use. Filters used for Multi-Metals and particulate mass measurements were weighed under constant conditions before shipment to the field. Battelle also supplied pre-cleaned containers for most of the flue gas and solid/liquid samples.

Other sampling materials were supplied by subcontractors. Chester supplied pre-cleaned VOST traps for use by both Chester and Battelle, and provided HEST carbon-impregnated filters and associated quartz particulate pre-filters for both groups. Chester provided cascade impactors and the necessary stage components for particle size determinations at Locations 5a and 5b. Zande Labs provided pre-cleaned 40-ml vials for headspace-free collection of liquid samples for VOC analysis.

C-3. Sample Preparation

The Battelle and Chester field sampling teams prepared their own respective sampling trains using the reagents and materials described above. Within each of the Battelle and Chester field teams, a single staff member was designated the Sample Recovery Leader. That person, and only that person, directed and approved the preparation and recovery of sampling trains. Each group used their own laboratory facilities on-site, as described below:

- Battelle's field laboratory is a 40-foot air conditioned semi-trailer equipped with a side entrance door and an electrically operated platform lift at the rear double doors. The trailer accepts 100 A of 125 V/250 V AC power by hardwiring to a transformer or switch box. This trailer served as the primary contact point for

Battelle and Chester staff, and was used for meetings among project personnel to review the previous day's activities and plan for the current day. Such meetings were especially necessary on the 6 sampling days, but were useful in the setup and shutdown phases of the field effort.

- Two 28-foot rental trucks equipped with side entrances were used by Battelle staff for preparation of flue gas sampling equipment and for recovery of some samples. The two trucks were equipped with tables, storage areas, and a desk for equipment setup, and sample recovery. One of these trucks was used as the sample recovery area for aldehyde samples only. This arrangement minimized contamination of aldehyde samples by acetone used in other activities.
- Chester Environmental's field laboratory was a laboratory trailer approximately 15 feet long, and equipped with lights, air conditioning, storage, and work areas. The laboratory trailer was used by Chester for preparation of sampling equipment, cleanup, sample recovery, and sample documentation tasks.

The facilities described above were positioned close to one another near the stack and the SNOX demonstration project at the SNOX process. That location was roughly centrally located among the various flue gas and process sampling locations. In addition, two commercial compressed gas tube trailers were positioned near the base of the Boiler No. 2 stack. Those trailers were obtained by Chester, and supplied the N_2 and O_2 needed as diluent gas in the plume dilution sampling at the stack.

Written procedures for reagent and train preparation were provided to field staff, and were posted in the train preparation areas of the Field Facilities. Copies of those documents, which included sample recovery as well as preparation procedures, are included at the end of this Appendix. All sampling reagents and trains were prepared under the direction of the Sample Recovery Leader. Every flue gas sampling train was accompanied by a chain-of-custody form specific for that sample and sampling location, from the moment the train was assembled. That custody form remained with the train throughout sampling, and was returned to the field laboratory with the train once sampling was completed. That same form was then used during sample recovery and documentation procedures.

C 4. Sampling Methods

Table C-1 presents a summary of the chemicals measured, the type of samples in which each chemical was measured, and the sampling methods used for each.

The sampling methods used were detailed in the QAPP for this study. Brief descriptions of the sampling methods are as follows:

USEPA Method 29 (Draft June, 1992) - Multiple Metals. Method 29 is designed to determine emissions of metals from stationary sources. In Method 29, flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated quartz filter and gaseous emissions collected in a series of chilled impingers. The series of impinger consists of two impingers containing a solution of dilute nitric acid and hydrogen peroxide, and two impingers containing a solution of dilute potassium permanganate and sulfuric acid.

A series of two glass cyclones preceded the pre-weighed quartz filter at the ESP inlet to provide size cuts of > 10 μm, 5-10 μm, and < 5 μm in the collected particulate matter. These cyclones were located in the heated sampler box along with the particulate filter. Thus the 10 μm and 5 μm cyclones replaced the single 10 μm cyclone normally used in the Method 5 type train. The cyclone cut points were based on a computer program used to design the cyclones. Insufficient time was available before the study to conduct confirmatory tests of the cyclone cut points.

Method 29 sampling at the baghouse inlet was modified to include the use of a flexible, heated, Teflon sample line connecting the probe to the heated cyclones and filter. The flexible heated line, which allowed the vertical sampling required at that location, was made of 1/2 in. diameter, thick-walled, smooth bore Teflon tubing and contained a temperature monitor. An empty impinger was used in the train for condensate drop-out.

USEPA Method 26A - Particulate Matter, Hydrogen Chloride, Hydrogen Fluoride. Sampling was conducted along the general procedures of EPA Method 26A, with adaptations to the guidelines of California Air Resources Board (CARB) Method 421 in the collection solution employed. Method 26A is designed to determine particulate matter,

TABLE C-1. SUMMARY OF REQUIRED MEASUREMENTS AND SAMPLING METHODS USED TO ACHIEVE THEM

Measurement	Type of Sample	Method
Volatile Organic Compounds (VOC)	Flue Gas	Summa Canisters[a]
	Flue Gas	Volatile Organic Sampling Train (VOST)
	Liquid	Process Sample Collection
Semivolatile Organic Compounds (SVOC)		
Polycyclic Aromatic Hydrocarbons (PAH)	Flue Gas (Vapor)	Method 23/Modified Method 5
and Other SVOC	Flue Gas (Particulate)	Method 23/Modified Method 5
	Solid	Process Sample Collection
	Liquid	Process Sample Collection
Volatile Elements (Hg, As, Se)	Flue Gas (Vapor)	Hazardous Element Sampling Train (HEST)
Elements	Flue Gas (Particulate)	Method 29
	Flue Gas (Vapor)	Method 29
	Solid	Process Sample Collection
	Liquid	Process Sample Collection
Anions (F^-, Cl^-, $PO_4^{=}$, $SO_4^{=}$)	Solid	Process Sample Collection
	Liquid	Process Sample Collection
	Flue Gas (Particulate)	Method 26A/CARB 421
HCl, HF	Flue Gas (Vapor)	Method 26A/CARB 421
Ammonia	Flue Gas (Vapor)	Impingers, APHA 401
	Liquid	Process Sample Collection
Cyanide	Flue Gas (Vapor)	Impingers, APHA 808
	Liquid	Process Sample Collection
Aldehydes	Flue Gas (Vapor)	TO-5, APHA 122
	Liquid	Process Sample Collection
Radionuclides	Solid	Process Sample Collection
	Flue Gas (Particle)	Filter from Ammonia/Cyanide Train

TABLE C-1. (Continued)

Measurement	Type of Sample	Method
Carbon	Solid	Process Sample Collection
	Flue Gas (Particle)	Filter from Ammonia/Cyanide Train
Particle Size Distribution	Flue Gas (Particle)	Impactors
	Flue Gas (Particle)	Cyclones with Method 29
	ESP Ash	Process Sample Collection
Moisture, Heat Content, Ultimate/Proximate	Boiler Feed Coal	Process Sample Collection

(a) On Method 23 train.

and hydrogen halides in the absence of other chloride-containing volatile species. It is suitable for combustion sources where the primary source of chloride is the dissociation of chlorinated organic compounds. In the present study this method was be used to determine HF/HCl and their corresponding particulate anions, as well as particulate $SO_4^{=}$ and PO_4^{3-}.

A sample of flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated filter and gaseous emissions collected in a series of chilled impingers containing a solution of sodium carbonate (1.8 mM) and sodium bicarbonate (1.7 mM). The method was used in this study in a single-point, nontraversing mode. The use of carbonate/bicarbonate solution as the collecting medium for HCl and HF followed the guidelines of CARB 421. The solution was prepared by a 1:1000 dilution of stock solution in the field. The same solution was used for rinsing of the probe and filter holder after sample collection. An empty impinger was used at the front of the chilled impinger train to collect condensed water from the stream. The collected condensate was saved as a sample fraction for chemical analysis.

<u>USEPA Method 23 - Semivolatile Organic Compounds</u>. Method 23 is designed to determine specifically dioxins and furans. In this study, Method 23 was adapted, according to Modified Method 5 guidelines, to measure polycyclic aromatic hydrocarbons (PAH). Thus Method 23 as referred to in this document is a modified method for measurement of PAH and other SVOC.

In addition, whole air samples were collected from the Method 23 train in SUMMA polished canisters, to determine volatile organic compounds (VOC). Samples for VOC were taken with both SUMMA canisters and VOST (volatile organics sampling train) for comparison of the two methods.

Glass cyclones were used in the Method 23 train as described above for the Multi-Metals train. At the ESP inlet the method employed a flexible heated Teflon sample line connecting the probe to the heated filter. The flexible heated line, which allowed the vertical sampling required at this location, was made of 1/2 in., thick-walled, Teflon tubing and contained a temperature monitor.

__Canister Method - VOC__. The SUMMA samples were taken directly into evacuated stainless steel canisters. The samples were taken from a tee in the Method 23 train between the condenser and the XAD-2 cartridge for the Chester samples, and were taken from a tee upstream of the integral condenser/XAD unit in the Battelle train. Each canister was equipped with a manual valve to maintain vacuum until sampling is initiated. A flow orifice was sized and installed in the sampling line (Teflon) between the tee and the canister valve, to provide a time integrated sample. The orifice was sized to allow the canister to fill over a one-half hour period. The Chester tee fitting was designed so that water condensing in the main air flow to the XAD-2 cartridge was separated by gravity from the small air flow (approximately 200 cm^3/min) flowing to the canister. This arrangement prevented water from clogging the flow orifice in the canister line. In the Battelle train, a glass midget impinger containing hydrogen peroxide solution was placed in an ice bath, and served to condense out moisture and remove SO_2 in the flow line upstream of the orifice. Each canister connection had a compound pressure/vacuum gauge attached. This gauge was used to measure the initial canister vacuum, monitor canister pressure during sampling, and record the final canister pressure after sampling. Three canister samples were taken (approximately simultaneously with three VOST samples) on each organic sampling day.

__VOST__. VOST samples for volatile organic analysis were taken with a Graseby-Nutech 280 Volatile Organics Sampling Train (VOST), or equivalent. Sampling was conducted consistent with the procedures of SW-846 Method 0030 which provides for the collection of volatile organic compounds by adsorption onto Tenax and Tenax/charcoal sorbents, and with the guidelines stated in the VOST manual (Graseby-Nutech, Durham, NC). The standard VOST consists of a glass-lined probe followed by an isolation valve, a water-cooled glass condenser, a sorbent cartridge containing Tenax (1.6 g), an empty impinger for condensate removal, a second water-cooled glass condenser, a second sorbent cartridge containing Tenax and petroleum-based charcoal (3:1 by volume; approximately 1 g of each), a silica gel drying tube, a calibrated rotameter, a sampling pump, and a dry gas meter. The gas pressure during sampling and for leak-checking was monitored by pressure gauges which are in line and downstream of the silica gel drying tube. In this study, the Tenax/charcoal sorbent traps were augmented with a combination of modern carbon-based sorbent materials (Carbosieve, Supelco, Inc.). This approach enhanced collection and recovery of a variety of volatile organics from the flue gas streams.

Each VOST run consisted of three samples, each of which comprised a pair of traps in the VOST system. The three samples were taken over periods of 5, 10, and 30 minutes, at a flow rate of 0.5 L/min. Each VOST sample was run during the same time period as the SUMMA canister samples collected from the Method 23 train.

Impinger Sampling. Sampling for gaseous aldehydes, cyanide, and ammonia was conducted using a series of impingers downstream of a Method 26A type train operating at a single point (i.e., nontraversing) in the flue gas flow. The front half of the train consisted of a glass nozzle, glass heated probe, and a heated quartz fiber filter. The back half of the train was a separate set of impingers prepared for each of the analytes listed above, and changed out sequentially over the course of each sampling day at intervals corresponding to the appropriate sampling times.

The aldehyde samples were taken after the general provisions of EPA Methods 0011 and TO-5 and APHA Method 122 (Aldehydes in Ambient Air and Source Emissions). The sample were collected nonisokinetically, and the filter was not analyzed for aldehydes. The first impinger was an empty condensate collector, and the next two impingers contained an acidic 2,4-dinitrophenylhydrazine (DNPH) solution in which aldehydes in the sample are converted to form stable DNPH derivatives. These were followed by a silica gel impinger and a pump and metering box. The aldehyde samples were run for 1 hour at a flow rate of 1.0 L/min.

The sampling train used for ammonia and cyanide contained a filter to collect material for radionuclide and residual carbon analysis. Sampling was isokinetic at a single point. The cyanide samples were taken after the general provisions of APHA Method 808 (Determination of Cyanide in Air) with an impinger train, as those described above, but containing a dilute sodium hydroxide solution to collect gaseous cyanide and retain it in ionic form. The sampling time was about 1 hour.

The ammonia sample was also taken with an impinger train after the provisions of APHA Method 401. The train was similar to those described above, but contained a dilute sulfuric acid solution. Ammonia in the sample gas is converted and retained in the impinger solution as ammonium sulfate. The sampling time was about one-half hour.

The need for analysis of the filter in Method 26A for F^- and Cl^- dictated a large sample flow for that method. Replacing impingers for HF and HCl with those for ammonia, and cyanide readily adapted Method 26A to sampling those constituents as well, but required use of standard glassware and reagent volumes. Consequently, sampling for gaseous ammonia and cyanide employed full-size Method 5 glassware, with sample flow rates of 10-15 L/min. A single particulate filter was used throughout the sampling of ammonia and cyanide in sequence, to maximize the particulate sample collected for radionuclide and residual carbon analysis.

HEST. The Hazardous Element Sampling Train (HEST) was used to determine volatile elements at the flue gas sampling locations. The HEST sampler consists of a filter pack with a stainless steel support screen, and three 47-mm filters. The air flow entering the HEST sampler first encountered a quartz filter for particle collection, followed by two charcoal impregnated filters for collection of volatile elements (arsenic, mercury, selenium). The first impregnated filter is for collection of the volatile elements, and the second allows checking for breakthrough. Because only volatile elements are of interest, the HEST was used for nonisokinetic, single point sampling.

Particle Size Determination. Glass cyclones were used to classify and collect particles by size at Location 18, the baghouse inlet. Pilot Model Mark III cascade impactors were used to determine particle size distributions in sampling at the baghouse inlet and outlet. The impactors had an inlet, seven impactor stages, and a back-up filter. The impactor performs aerodynamic sizing by routing the sample through a series of bends of increasing sharpness and jets of diminishing diameter. As the gas passes through the impactor jets, aerosol particles, which due to inertia cannot follow the gas flow stream, land on glass fiber filters attached to back-up plates. The smaller particles remain in the gas stream, continuing on to the next stage. With each successive stage, the mean diameter of the particles decreases down to the final back-up filter, which screens out all remaining particulate. The actual aerodynamic cut size per stage depends on the velocities of the gas through the impactor. All impaction substrates and the backup filter were of Reeve-Angel 934 AH glass fiber mats. This material is reported to have very low characteristics for absorption of SO_2/SO_3.

A summary of the testing methodology follows:

1. Isokinetic sampling rates, nozzle size and sampling times were calculated based on preliminary velocity, temperature and moisture characteristics.
2. The units were assembled and sealed in a clean area, transported to the sampling location, attached to the sampling probe and train, and tested for leakage at 15 in. Hg vacuum.
3. The sampling head was then pointed downstream for a minimum of 10 minutes, to allow the assembly to warm to stack temperature. The assembly was then turned 180 degrees to begin sampling. The sampling consisted of a single point sample, collected isokinetically at a point of average flue velocity.
4. After the sample was collected, the sampling head was removed from the stack, disconnected from the sampling probe, sealed and transported to a clean area for disassembly and sample recovery. Collection plate filters were removed stage by stage using tweezers and placed in separate, labelled petri dishes. The jet stages were examined and any blocked jets cleaned.
5. The petri dishes were sealed for transport to Chester's laboratory for gravimetric determinations. The sampling head was then reassembled for the next test.

C-5. Sample Storage and Recovery Procedures

Flue gas sampling trains were returned to the field laboratories after sampling for sample recovery by the Sample Recovery Leader. Sample recovery areas were off-limits to all but those staff involved in the actual preparation, recovery, and documentation of samples. Sample recovery was generally done after the completion of all sampling for the day, and after sampling staff had left the site. This further minimized interference in the sample recovery process. Sample recovery procedures were set out in single-sheet protocol forms, that detailed the train preparation and sample recovery steps for each train. These forms were distributed to sampling staff and were posted at each sample recovery area in the field laboratories.

Samples recovered typically involved several portions or fractions of various types, or intended for various purposes. Samples were preserved and stored under conditions appropriate for the sample type. Table C-2 summarizes the preservation and storage conditions for various samples. Sample preservation consisted of adjustment of pH for liquid or impinger samples. Most samples were refrigerated in the Battelle field facility (4 C), or were stored at room temperature in shipping boxes ready for transfer to the analytical laboratory. The Modified Method 5 (Method 23) particulate filters were stored on dry ice in the field to maintain the -78 C temperature indicated.

Although as Table C-2 indicates holding times for the collected samples were quite long, in practice some samples were returned to the analytical laboratories immediately after collection by daily express shipment from the plant site. Those samples included liquid samples for anions, VOC, and SVOC, Summa canisters, VOST cartridges, and (when space was available) impinger samples from flue gas trains. Other samples were returned to Battelle with the field facilities at the end of the study. Chain-of-custody forms accompanied all samples at all times during storage on-site at Niles, and during shipment. A Battelle staff member was designated to serve as Chain-of-Custody officer at Battelle for samples sent back or brought back from the field study. That staff member had complete control over access to samples at Battelle, and distributed samples to the appropriate analytical staff only after cross-checking of chain-of-custody forms.

C-6. Sampling QA/QC

Quality assurance activities in field sampling included collecting samples of all reagent and rinse solutions, including deionized water, for use as reagent blanks. Method blanks were also collected, by preparing a complete sampling train, exposing it to the normal handling and transport procedures used before and after sampling, and recovering the train without sampling of flue gas. This procedure exposes the train to potential sources of background contamination as in normal sampling. In addition, specific QC procedures

TABLE C-2. PRESERVATION AND STORAGE REQUIREMENTS

Sample	Analysis[a]	Preservation Requirements	Storage Conditions	Holding Time
Bulk Solid Samples	Elements, F-C-P	None	Room Temperature	30 days
	SVOC	None	Room Temperature	30 days
	U/P, RAD	None	Room Temperature	30 days
Liquid Samples	Dissolved trace elements	HNO_3 to pH <2	Room Temperature	30 days
	Total trace elements	HNO_3 to pH <2	Room Temperature	30 days
	Anions	None	4°C	14 days[c,d]
	VOC	No headspace	4°C	14 days[c]
	SVOC	None	4°C	14 days[b,c]
	CN	NaOH to pH >12	4°C	14 days
	NH_4	H_2SO_4 to pH <2	4°C	14 days
Method 29 Train				
Impinger Solutions	Trace Elements	HNO_3 to pH <2	4°C	30 days
Particulate Filter	Trace Elements	None	Room Temperature	30 days
Method 23 Train				
XAD-2 Resin	SVOC	None	4°C	28 days
Particulate Filter	SVOC	None	-78°C	28 days
Summa Canister	VOC	None	Room Temperture	2 days[c]
Aldehyde Impinger Train	Aldehydes	None	4°C	28 days
HEST Samples	Hg, As, Se	None	4°C	6 months
Ammonia Train Impinger Solutions, Liquids	Ammonia	None	4°C	14 days
CN Train Impinger Solutions	CN	None	4°C	28 days
Method 26A Train Impinger Solutions	HF, HCl	None	4°C	28 days
Method 26A Train Filter	$SO_4^=$, $PO_4^{\equiv}$, F^-, Cl^-			
VOST Cartridges	VOC	None	4°C	14 days

(a) F-C-P = Fluoride, Chloride, Phosphate
SVOC = Semi-volatile Organics
VOC = Volatile Organics
RAD = Radionuclides
UP = Ultimate/proximate coal analyses.
C = Carbon.
CN = Cyanide.
NH_4 = Ammonia.

(b) Extracted within 14 days, analysis within 40 days of extraction.

(c) Samples were returned to Battelle within 24 hours after collection in the field.

(d) Liquid samples were analyzed as soon as possible for phosphate to minimize degradation of this analyte in these samples.

specific to each of the sampling methods were used. Those specific procedures are described briefly below:

QC Checks for Velocity/Volumetric Flowrate Determination. Prior to flue gas sampling, volumetric gas flow rate data were collected at the flue gas sampling locations, using the procedures specified in EPA Method 2. Quality control procedures were as follows:

- Visually inspect the S-type pitot tube or standard pitot tube before and after sampling.
- Leak-check both legs of the pitot tube before and after sampling.
- Check the number and location of the sampling traverse points before taking measurements.
- Clean and check inlet tubes periodically and clear ash from impact side of pitot tube as necessary.

Quality Control Procedures for Moisture Determination. The moisture content of the gas streams was determined using the technique specified in EPA Method 4. However, the actual moisture sampling was conducted as part of Methods 23, Method 5, and Method 29 sampling procedures at the flue gas locations. The following internal QC checks were performed as part of the moisture determinations:

- The volume of impinger contents was measured by weighing to the nearest gram before and after sampling.
- The sampling train (including impingers) was leak-checked before and after each run.
- Ice was maintained in the ice bath throughout each run.
- The volume of water in the collection bottle, into which water from the first impinger was periodically drained, was measured by weighing to the nearest gram.

Quality Control Procedures for Flue Gas Sampling Methods. The following pretest QC checks were conducted for all flue gas sampling methods:

- All sampling equipment was thoroughly checked to ensure clean and operable components.
- Equipment was inspected for possible damage from shipment.
- The oil manometer or Magnehelic gauge used to measure pressure across the pitot tube was levelled and zeroed.
- The pitot tubes and connecting tubing were leak checked
- The temperature measurement system was visually checked for damage and operability by measuring the ambient temperature prior to each traverse.

In addition to the general QC procedures listed above, QC procedures specific to each sampling method were also incorporated into the sampling scheme. These method-specific procedures are discussed below.

Quality Control Procedures for Method 29. EPA Method 29 was used to sample for vapor phase and particulate elements. The following quality control procedures were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.
- All cleaned glassware was kept closed with tightly closed ground glass caps or Teflon tape.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.

During Testing Each Day

- The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.
- The train was leak-checked before and after a run, if the train was opened for any reason, and if a filter change took place.
- Additional leak-checks were conducted if a leak exceeded 4 percent of the sampling rate, and efforts were made to improve the leak tightness of the train.
- The filter was maintained at the proper temperature.
- Ice was kept in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field operator data sheets are shown in Appendix D.
- Isokinetic sampling was maintained within about 15 percent.
- Sample train and field blanks were collected for analysis and maintained at approximately 4°C.

After Testing Each Day

- The final meter reading was recorded.
- Completeness of the data sheet was checked.
- A final leak-check of the sampling train was done at the maximum vacuum observed during the test.
- Each leg of pitot tubes was leak-checked.

- Recovered train following prescribed procedures.

Quality Control Procedures for Method 23 (Modified Method 5, with Summa Canisters).

Prior to Start of All Testing

- The Method 23 trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.
- All quartz filters to be used were muffled and cleaned XAD was prepared.
- Openings of all cleaned glassware and prepared sorbent traps were closed with ground glass caps or precleaned foil until train assembly.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape, and enclosed in aluminum foil.
- Pretest calculations were done to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.
- The Summa canisters were checked for proper vacuum.

During Testing Each Day

- The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.
- The train was leak-checked before and after the run, if the train was opened, and if a filter change took place.

- Additional leak-checks were conducted if the leak exceeded 4 percent of the sampling rate, and steps were taken to improve the leak tightness of the train.
- The filter and sorbent trap were maintained at the proper temperatures.
- Ice was kept in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field data sheets are included in Appendix D.
- Isokinetic sampling was maintained within 15 percent.
- Sample train and field blanks were collected for PAH and dioxin/furan.
- Canister pressure was monitored by means of a pressure gauge throughout filling of the canister.

<u>After Testing Each Day</u>

- Final meter reading was recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Final canister pressure was recorded, and the canister tightly closed.
- Each leg of pitot tubes was leak-checked.
- The probe rinses and remaining train were recovered following prescribed procedures.
- Nozzle and cap were reattached for next day and the train was stored in a dry, safe place.

<u>Quality Control Procedures for Method 26A (Impinger Sampling Methods (Cyanide, Acid Gases, Aldehydes, Ammonia)</u>. Impinger-based sampling procedures were used for sampling aldehydes and inorganic compounds. These methods were conducted at

single points in the flue gas stream, isokinetically except for the aldehyde sampling. The following general quality control procedures applicable to all these methods were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.

Prior to Testing Each Day

- Fresh impinger and rinse solutions were prepared.
- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The filter was maintained at the proper temperature.
- Ice was maintained in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum during sampling at each traverse point were made. Sampling data sheets for these methods are included in Appendix D.
- Sample train and field blanks were collected for analysis.

After Testing Each Day

- Final readings were recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Impinger solutions and rinses were recovered according to prescribed procedures.

Quality Control Procedures for VOST. Sampling for volatile organics was conducted using a Volatile Organic Sampling Train (VOST). The following are key quality control procedures followed in the field:

Prior to Start of All Testing

- VOST glassware was cleaned and assembled.
- The entire unit was assembled, visually inspected, leak tested, and its operation was checked.
- All VOST traps were cleaned, sealed, and labelled.

Prior to Testing Each Day

- VOST sorbent traps were kept sealed and stored in a refrigerator at 4°C.
- The VOST unit was assembled, minimizing the amount of time that the sorbent trap was open to air.
- A visual inspection was made and a leak test was made.

During Testing

- Flow rate was monitored.
- Operation of probe heater was monitored.
- Flow of ice water to condenser was maintained.
- Sampling time was watched closely, so the sampling interval was not overrun.

After Testing

- Final leak-check was performed.
- Sorbent traps were sealed immediately upon disassembly of the unit, and stored at 4°C until shipment for analysis.
- The VOST was prepared for its next use.

Quality Control Procedures for HEST Sampler. Volatile elements in flue gas were determined by means of a HEST sampler, that used carbon impregnated (CI) filters for collection of the metals. Field QC procedures for the HEST were as follows:

Prior to All Testing

- Lab ID numbers were recorded on the petri dishes in which the quartz and carbon impregnated (CI) filters are supplied.
- A clean table area for loading of the HEST filters was prepared.

Prior to Testing Each Day

- The positions of the one quartz and two CI filters in series were recorded as they were loaded, and recorded on the sample data sheet with the corresponding lab ID numbers.
- Both sides of each filter were examined to assure the proper side faced the air flow.
- Teflon-coated tweezers were used in loading the filters.
- The HEST filter assembly was visually inspected during and after assembly.
- Both ends of the assembly were sealed, and the entire assembly was then sealed in a clean plastic bag.

During Testing

- The system was leak tested after attachment of the HEST assembly to the probe.
- Condensate was not allowed to backwash into the HEST assembly.
- When inserting the HEST into the duct, care was taken to avoid scraping the head on the port.
- A proper seal was confirmed between the probe and port.
- Flow rate, sample time, and normal Method 5 sampling parameters were recorded.

After Testing

- When the assembly was removed from the duct, care was taken to avoid scraping the head on the port.
- Final leak test was performed.
- The HEST was kept vertical while the system was disassembled.

- The HEST was sealed, allowed to cool, and the entire assembly was then sealed into a plastic bag.
- Filters were kept flat with deposit side up while disassembling the HEST.
- Filters were placed flat with deposit side up in labelled petri dishes.
- Petri dishes were stored flat.
- Probe and filter chamber were rinsed with acetone and 0.1N HNO_3, and combined washes in a labelled sample jar.

Quality Control Procedures for Particle Size Distributions. At designated sampling locations, particle size distributions in flue gas were determined by cyclone or impactor sampling. The cyclones were incorporated in the Method 29 and Method 23 trains covered above, and used at Location 4. The following are QC procedures applicable to impactor sampling, which was conducted at Locations 5a and 5b.

Prior to Start of All Testing

- All impactor stage filters were preweighed.
- The impactors were assembled in an environment free from uncontrolled dust.
- Each unit was visually inspected for proper assembly.
- Labelled petri dishes were prepared for storage of impactor after sampling.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The impactor was allowed to warm to flue gas temperature before sampling.
- Isokinetic sampling was maintained within 10 percent.

After Testing Each Day

- Final leak-check of unit was done at maximum vacuum during test.
- Impactor was recovered following prescribed procedures.
- The impactor head was removed from the sampling probe, and sealed for transport to a clean disassembly area.
- Impactor filters were placed in pre-labelled dishes, and the impactor was cleaned for the next run.

Quality Control Procedures for Process Sample Collection. The process sampling quality control included the following procedures:

- The sampling equipment was cleaned and proper sample containers were used.
- Proper scheduling of sampling times was based on consultation with Niles staff.
- Immediate labelling of all samples was done at the time of collection.
- Observations were recorded on preformatted data sheets.
- Log-in and chain-of-custody procedures began as soon as samples were returned to the field laboratory.

APPENDIX D

FIELD SAMPLING DATA SHEETS

APPENDIX D

FIELD SAMPLING DATA SHEETS

In this Appendix, copies are provided of the original field sampling data sheets from the SNOX field study. These sheets show the data recorded by the Battelle and Chester staff in conducting the flue gas measurements. The data sheets are organized in the following order:

D-1: Modified Method 5
D-2: Multi-Metals
D-3: Anions Train
D-4: Ammonia Train
D-5: Cyanide Train
D-6: Aldehyde Train
D-7: VOST Train
D-8: HEST Samples
D-9: Cascade Impactors
D-10: Calculations of Flue Gas Sampling Parameters and Particulate Matter Concentration

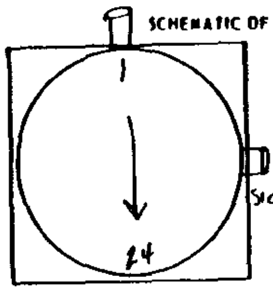
Within each of these sections, the data sheets are presented in order by site and date. For example, in Section D-1, data sheets from sites 18, 19, 20, and 21 on July 18 are provided, followed by those from sites 18, 19, 20, and 21 on July 21.

D-1: Modified Method 5 (Method 23)

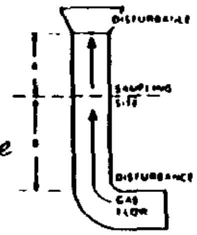
PARTICULATE FIELD DATA

N-18-MM5-718

SCHEMATIC OF STACK



CROSS SECTION



PLANT Niles
DATE 7-18-93
LOCATION BH IN 18
OPERATOR Webb/Cox
STACK NO
RUN NO. 1 Organics
SAMPLE BOX NO
METER BOX NO. X 40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in .247
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR .9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Top TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in H₂O)~~	4 STACK TEMPERATURE (Tₛ), °F	10₂ VELOCITY HEAD (ΔPₛ)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tm in), °F	7 OUTLET (Tm out), °F	3 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER #8 °F		PUMP VACUUM in. Hg gauge	XAD? VELOCITY
2	0	10:10	435	.6	4.3	1.3	1.3	832.843	95	91		Filt	Imp	7	
3	16		400	.3		.65	.65	846.3	97	93	260		62	6	44
4	24	10:34	420	.92		.92	.92	850.9							
5	32		433	.52	4.0	1.2	1.2	854.0	101	97	258	267		8.5	52
6	40	10:50	424	.60		1.3	1.3	859.2							41
7	48		424	.64	4.2	1.4	1.4	864.8	102	99	259	267	55	9.5	
8	56		421	.69	3.9	1.5	1.5	870.1							
9	4		422	.7		1.5	1.5	877.2							
10	12		432	.75		1.7	1.7	882.2	105	104	260	260	64	14	39
11	20	11:30	416	.78	4.5	1.2	1.7	887.0							
12	28		423	.84		1.1	1.84								
Stop	36	11:48													
	~~0~~	~~11:50~~													
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

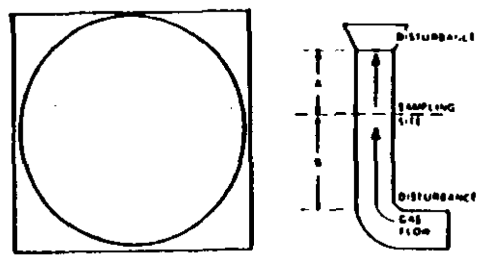
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Didn't do point #1

2

PARTICULATE 'IELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 7-18-93
LOCATION BH IN 18
OPERATOR Webb / Coy
STACK NO.
RUN NO. 1 Organics
SAMPLE BOX NO
METER BOX NO. X 40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Top TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in H2O)~~	4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	P_2 ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	7 OUTLET ($T_{m_{out}}$), °F	3 SAMPLE BOX TEMPERATURE °F	TEMPERATURE ~~OF GAS LEAVING CONDENSER OR LAST IMPINGER~~ °F Filter	Imp	PUMP VACUUM in. Hg gauge	X10-? F ~~VELOCITY~~
13	0	11:50	398	1.0	4.8	1.9	2.2	898.1	105	105	256	Filter	Imp	21.5	39
14	8		397	.98		1.8	2.15	903.5				256	62		
15	16	12:06	400	.94		1.6	2.0	911.0	107	106	258	256			
16	24		400	.86		1.5	1.84								46
17	32		409	.86	4.6	1.4	1.84	921.8							
18	40		405	.78		1.3	1.70	930.0	107	108	256	255			
19	48	12:38	403	.78		1.3	1.70						74	22.5	42
20	56		405	.78	5.0	1.2	1.70	939.6							
21	04		415	.75		1.1	1.69								
22	~~4~~	12:58	STOP -	Stop pic	broken			945.9	5 min	to go at	the point				
~~22~~	~~16~~	13:11	397	Remain					107	107	258	257		21	41
~~22~~	12	can't	reach pt	22-23											
~~23~~	~~28~~														
24	~~36~~	13:32	stop	.3	4.4	.45	.65	broken	shear	pin					
24		13:44	Start 413	.25		.52	.52	957.0			257	259	72	19	50
~~TOTAL~~	36	13:52	Stop					961.084							

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

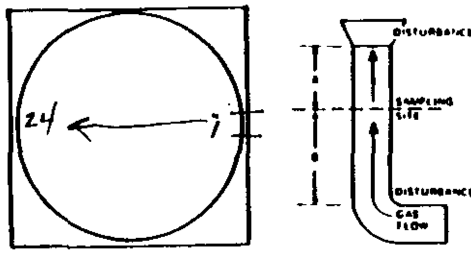
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Pre leak check .015 cfm at 11

3

PARTICULATE 'IELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT: Niles
DATE: 7-18-93
LOCATION: Bit, IN 18
OPERATOR: Webb / Cox
STACK NO.:
RUN NO.: 1 Organic
SAMPLE BOX NO:
METER BOX NO.: X-40513

AMBIENT TEMPERATURE: 90
BAROMETRIC PRESSURE: 29.08
ASSUMED MOISTURE, %: 6
PROBE LENGTH, in: 96
NOZZLE DIAMETER, in: .247
STACK DIAMETER, in: 80
PROBE HEATER SETTING: 250
HEATER BOX SETTING: 250

METER ΔH@: 1.64
C FACTOR: 0.9
PROCESS WEIGHT RATE:

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Side TRAVERSE POINT NUMBER	Pos SAMPLING ~~TIME~~ (θ), min	Time ~~STATIC PRESSURE (in H₂O)~~	4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	O_2 ~~($\sqrt{\Delta P_s}$)~~	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	7 OUTLET ($T_{m_{out}}$), °F	3 Box SAMPLE ~~BOX~~ TEMPERATURE °F	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	XAD-? ~~VELOCITY~~
1	0	5:34P	256	.28		.6		961.3	102	101	255	259	Filt	5.5	
2	16			,				965.1					67		45
3	24		319	.50	3.9	1.1		969.2	107	103					
4	32		357	.65		1.4	1.4	973.5						8.5	42
5	40		364	.75	3.8	1.7	1.7	979.5	111	105	257	257	64	11.0	
6	48		366	.85		1.8	1.8	985.2							
7	56	6:30P	363	.90	3.8	1.95	1.95	991.6	113	106	255	258			40
8	4		364	.95		2.1	2.1	998.2						15.5	
9	12		365	1.1	3.8	2.0	2.4	1004.4	114	107	252	257	65		
10	20	6:54	365	1.1		2.0	2.4	~~10~~					254	19	38
11	28		371	1.1		1.9	2.4	16.6							
12	36		378	1.1	3.7	1.7	2.4	23.3							
TOTAL															

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

• 0 Δp - pt #1

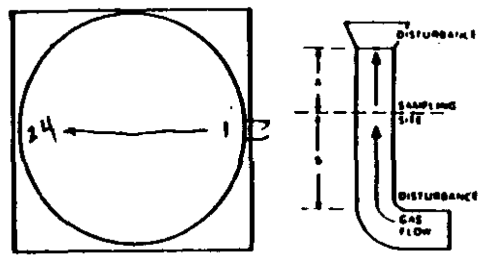
COMMENTS • Pre leak check Second Rely (Changed Filter) = .012 cfm
• % O_2 via Paramagnetic

Chicago Scientific Inc

4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 7-18-93
LOCATION #18 BH INLET
OPERATOR Webb / Coy
STACK NO.
RUN NO. 1 Organic
SAMPLE BOX NO
METER BOX NO. X-40573

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.07
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in .247
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Side TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC~~ PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F 3 Bot	2 Probe	TEMPERATURE OF GAS LEAVING ~~CONDENSER OR LAST IMPINGER~~ °F Imp	Filt	PUMP VACUUM in. Hg gauge	XAD. ~~VELOCITY~~
								1000								
13	44		393	1.1	3.9	1.7	2.4	29.7	111	108	255			257	20	52
14	52	7:26P	404	1.0		1.7	2.2	40.6					68			
15	60		408	.95		1.4	2.1									
16	68	7:40	408	.95	4.1	1.4	2.1	47.7	107	106	255	257	67	257	22½	38
17	16	~~7:40~~	408	.92		1.3	2.01									
18	24	7:58	414	.92		1.2	2.05	58.0	106	109	252	258	69	259	22½	38
19	32		415	.87	4.2	1.2	1.9	62.3								
20	40		419	.87		1.1	1.9	67.2	104	109			65		23	38
21	48	8:22P	420	.82	9.5	1.0	1.8	73.0								
22	56		421	.78		1.0	1.7	77.9	103	102	255	260	65	260	23	40
23	4		422	.78		1.0	1.7	82.5								
24	8			.65			1.45		Filter	Port Broken						
		8:41P	Stop					88.96								
TOTAL	192															
AVERAGE																

1088.96
832.843
256.117 ft³

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Post leak check .018 at 23.
w/o s/s probe
with s/s probe at 4" Hg° N

NOMOGRAPH DATA

PLANT Niles, Ohio, SNOX process

DATE July 18, 1993

SAMPLING LOCATION outlet of bag house

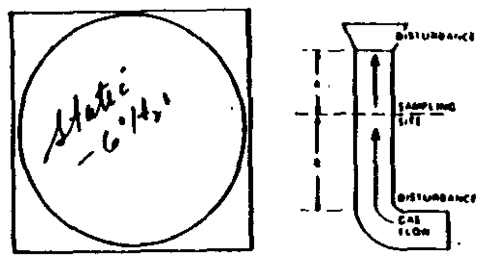
N-19-MM5-718

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg (P_m ± 0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	27" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	14/15
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	380°
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.642
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	1.05
C FACTOR	0.90	
CALCULATED NOZZLE DIAMETER, in.	0.260	
ACTUAL NOZZLE DIAMETER, in.	0.247	
REFERENCE Δp, in. H_2O	0.82	

EPA (Dur) 234
4/72

PARTICULATE 'ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio, SHoxxxxx

DATE July 18, 1993

LOCATION Outlet of baghouse

OPERATOR Leonard, Hasp

STACK NO

RUN NO. N-19-MM5-718

SAMPLE BOX NO. 3

METER BOX NO. X-40523

AMBIENT TEMPERATURE 68

BAROMETRIC PRESSURE 29.15

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 8 ft. glass

NOZZLE DIAMETER, in. 0.247

STACK DIAMETER, in. 8 ft

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER ΔH@ 1.65

C FACTOR 0.90

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp. STATIC PRESSURE (in H₂O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps (0₂%)
1	0/10:10	255	336	0.37	0.82	0.82	422.723	75	75	259	59	9.2	4.5
2	10/10:30	256	380	0.52	1.18	1.18	428.1	77	76	[illegible] 260	56	10.5	4.5
3	20/10:40	257	380	0.69	1.50	1.50	434.0	80	78	[illegible] 260	57	12.5	4.5
4	30/10:50	256	384	0.66	1.50	1.50	441.0	81	79	[illegible] 260	57	13.6	4.6
5	40/11:00	260	386	0.73	1.60	1.60	447.8	84	81	261	57	13.8	4.5
6	50/11:10	256	387	0.65	1.50	1.50	454.6	86	83	[illegible] 261	61	13.8	4.6
7	60/11:20	256	388				462.0			[illegible]			
	61/11:22	power off											
	62/11:25	power on											
	63/11:26	power off											
	68/11:30	power on		0.64	1.50	1.50	~~467.5~~						
8	70/11:37	257	390	0.61	1.40	1.40	467.5	89	87	[illegible] 261	60	14.5	4.6
9	80/11:47	258	394	0.60	1.35	1.35	474.3	90	88	11" 257	62	14.0	4.6
10	87.5/11:55	257	393	0.60	1.35	1.35	479.5	92	90	10" 262	65	14.0	5.0
11	95/12:02	257	391	0.52	1.18	1.18	484.6	93	91	[illegible] 261	64	13.2	4.6
TOTAL										40"			
AVERAGE										installing	101°C		

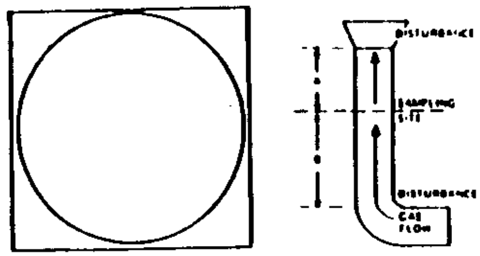
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT niles Ohio, SNOX process
DATE July 18, 1993
LOCATION outlet of baghouse
OPERATOR Lenard, Hupp
STACK NO ______
RUN NO. N-19-MM5-718
SAMPLE BOX NO 3
METER BOX NO. x-40563

AMBIENT TEMPERATURE 73
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8.00
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe Temp STATIC PRESSURE (in H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY fps
12	102.5/12:02	260	390	0.57	1.30	1.30	489.8	93	91	260	65	13.2	4.7
13	110/12:17	268	392	0.86	1.95	1.95	494.5	94	92	261	66	17.5	5.0
14	117.5/12:245	351	389	0.95	2.25	2.10	500.0	93	92	259	65	17.5	5.0
15	125/12:32	378	388	0.92	1.95	2.05	506.0	92	92	257	65	17.5	4.8
16	132.5/12:395	385	388	0.90	1.85	2.00	512.8	91	91	259	66	17.5	5.0
17	140/12:47	385	388	0.77	1.75	1.75	517.6	90	91	259	66	17.5	5.2
18	147.5/12:545	385	387	0.73	1.65	1.65	523.1	90	91	259	67	17.2	5.4
18	150/12:57	off pin sheared					525.219						
18	150/13:12	on					525.219						
19	155/13:17	385	388	0.56	1.30	1.30	529.1	92	93	261	67	14.2	5.0
20	162.5/13:245	386	389	0.47	1.10	1.10	534.1	92	93	261	67	13.2	5.0
20	164/13:26	off power off					535.268						
	13:28	power on											
	13:30	sheared pin											
20	164/13:46	on		0.47			535.268						
TOTAL													
AVERAGE													

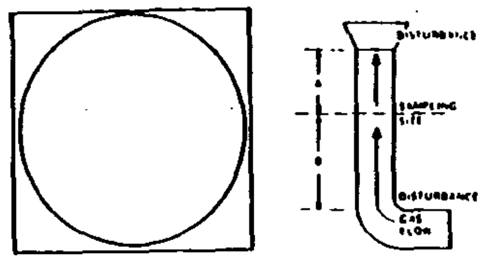
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

PARTICULATE 'IELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles Ohio, SNOX process
DATE July 19, 1993
LOCATION outlet of baghouse
OPERATOR Leonard, Hyp
STACK NO
RUN NO. N-19-MM5-718
SAMPLE BOX NO 3
METER BOX NO X-40513

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in 0.247
STACK DIAMETER, in. 8 ft.
PROBE HEATER SETTING 350°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe Temp, °F / STATIC PRESSURE (in H₂O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O₂% VELOCITY fps
21	170/13:52	385	383	0.41	0.93	0.93	539.0	90	91	260	66	13.2	6.3
22	177.5/13:58	382	383	0.43	0.95	0.95	543.4	92	92	261	68	11.8	6.2
22	178/14:05	off sheared pin					546.802						
22	183/14:36	on + off lost power					546.822						
22	183/14:38	on					546.822						
22	183/14:40	off power					548.164						
23	185/14:43	on		0.43	0.95	0.95	548.164						
24	192.5/14:50.5	383	384	0.30	0.66	0.66	552.7	97	96	262	68	9.6	5.1
	200/14:58	off	finish Top				556.274						
SIDE 1	200/15:09	on		0.24	0.54	0.54	556.274					8.8	
2	207.5/15:16.5	256	361	0.31	0.70	0.70	559.6	99	98	260	72	10.0	5.2
3	215/15:24	254	374	0.70	1.60	1.60	563.2	99	98	259	72	15.2	5.2
4	222.5/15:31.5	255	381	0.53	1.20	1.20	568.8	100	97	261	73	15.0	5.0
5	230/15:40	256	384	0.53	1.20	1.20	573.9	99	99	260	74	14.8	5.2
TOTAL													

AVERAGE

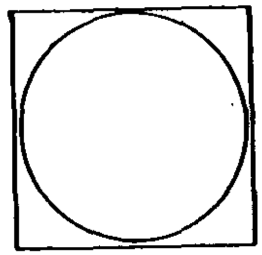
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

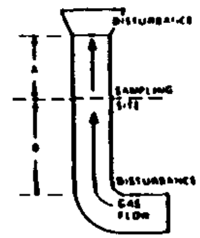
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

PARTICULATE FIELD DATA

SCHEMATIC OF STACK





PLANT Niles, Ohio SNOX process
DATE July 18 1993
LOCATION outlet of baghouse
OPERATOR Leonard, Hupp
STACK NO. ______
RUN NO. N-19-MM5-718
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.249
STACK DIAMETER, in. 8 ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

	TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F (STATIC PRESSURE (in-H2O))	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in., H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O2 % VELOCITY
10	6	237.5/15:47.5	257	383	0.64		1.45	1.45	579.1	100	99	260	75	15.2	5.1
10	7	245/15:55	258	383	0.61		1.40	1.40	584.0	100	99	260	75	65.5	5.0
10	8	252.5/16:02.5	258	383	0.67		1.50	1.50	589.0	99	99	257	74	15.8	4.9
40	9	260/16:10	259	384	0.64		1.45	1.45	594.3	102	101	261	77	15.5	5.1
40	10	267.5/16:17.5	258	382	0.81		1.85	1.85	599.6	102	101	260	68	17.6	5.3
10	11	275/16:25	254	383	0.70		1.60	1.60	605.1	99	100	260	65	17.0	5.2
40	12	282.5/16:32.5	256	383	0.77		1.65	1.75	610.6	99	100	260	65	17.5	5.1
10	13	290/16:40	277	390	0.91		1.65	2.00	616.1	102	102	263	67	18.0	5.2
10	14	297.5/16:47.5	342	382	0.91		1.65	2.00	621.6	99	100	259	64	18.0	5.3
10	15	305/16:55	370	382	0.86		1.65	1.95	627.1	99	100	260	66	18.0	4.9
10	16	312.5/17:02.5	377	382	0.80		1.65	1.80	632.6	98	99	259	65	18.0	5.1
10	17	320/17:10	378	382	0.77		1.65	1.75	638.1	100	100	261	66	18.0	4.9
10	18	327.5/17:17.5	379	382	0.69		1.60	1.60	643.6	102	102	262	67	18.0	5.0
10	19	335/17:25	379	382	0.69		1.60	1.60	649.1	102	102	261	66	18.0	5.1
	20	342.5/17:32.5	379	381	0.64		1.45	1.45	654.7	104	103	260	67	17.6	5.0
	TOTAL														
	AVERAGE														

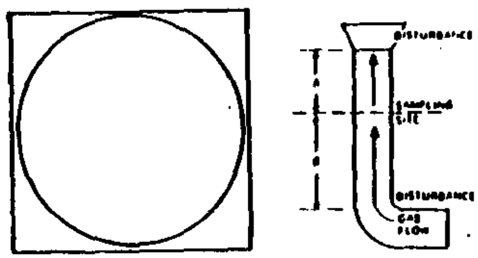
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

PARTICULATE :ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE July 18, 1993
LOCATION outlet of baghouse
OPERATOR Leonard, Kuss
STACK NO. ______
RUN NO. N-19-MM5-0710
SAMPLE BOX NO 3
METER BOX NO. X40513

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PROBE WAS	
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			
	TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	probe temp. of ~~STATIC PRESSURE (in. H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY
21	350/17:40	378	382	0.65	1.60	1.60	660.1	103	103	261	67	17.2	5.0
22	357.5/17:48	377	382	0.63	1.45	1.46	671.1	102	103	261	68	17.2	5.4
23	365/17:55	377	380	0.47	1.10	1.10	672.3	102	103	259	68	16.4	6.2
24	372.5/18:03	378	380	0.49	1.10	1.10	67[illegible].0	102	103	260	69	16.2	5.3
	380/18:10	off					681.084						
TOTAL													
AVERAGE													

leak check 0.024 at. 18.0" Hg

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
...TED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-18-93 (Sun.)	ORIFICE CORRECTION (ΔH@) 1.572	HOT/COLD BOX NO. 8
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MM5-7/18	METER CORRECTION (Y) 1.0151	PROBE NO. 13-1
PROJECT NO. 93C628-01	NOZZLE (SIZE,#) 0.448 #G-37	CALIBRATION DATE 07-02-93	FILTER NO. unweighed
TEST CREW CPC DB	STATIC PRESSURE +17.0" H_2O	PITOT CORRECTION 0.84	STACK DIA.
BAROMETRIC PRESSURE 29.30	PORT DIRECTION Port 1, Port 4	CONTROL BOX NO. THREE	PORT SIZE 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
15.0"	10:30	527.352	.03	.51	.51	85	77	1.0	600	~250°F	<68°F	~250°	1.5 min./point
		527.352	.03	.51	.51	89	78	1.0	599				
			.02	.34	.34	92	90	1.0	601				Bonsic trip [illegible]
45"			.05	.86	.86	98	84	2.0	613				[illegible]
			.05	.86	.86	100	86	2.0	614				Continue total
			.05	.86	.86	102	87	2.0	613				Sample time.
75"			.03	.51	.51	103	90	1.0	613				
			.04	.68	.68	104	91	1.0	613				Switched to [illegible]
			.04	.68	.68	104	91	1.0	613				[illegible] valve on
105"			.04	.68	.68	103	94	1.0	615				Port 4 &
			.05	.86	.86	106	94	2.5	616				will stay [illegible]
	11:33	557.030	.04	.68	.68	108	95	2.0	616				Port #4
													Sampling time
15.0"	13:08	558.750	.07	1.20	1.20	101	96	4.0	672				30 min/PT
10.5"			.07	1.20	1.20	108	97	4.0	674				
			.07	1.20	1.20	110	97	4.0	672				Estimates:
105"	14:12	569.549	.07	1.54	1.54	113	98	5.0	672				MW=29.2
1.5"													%H2O=9

Port 1 / Port 4

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.02 cfm
After	15.0	<0.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	ok/15 sec	ok/15 sec
After	ok/15 sec	ok/15 sec

GAS	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Dry

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	XAD-2 + condensate	1586.7	1227.6	359.1
2.	Empty	390.1	373.8	16.3
3.	100 mL D.I. H_2O	595.0	549.2	45.8
4.	100 mL D.I. H_2O	483.6	535.5	-51.8
5.	200g Silica Gel	657.8	644.1	13.7
	200g Silica Gel			31.3

Actual Moisture 8.9

414.[illegible] g total

0	0	X	0	0	0	0	
7	6	X	4	3	2	1	

FLOW ↓

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT BattelLE / DOE
TEST UNIT SCR Reactor outlet
PROJECT NO. 93c028-01
TEST CREW RC, DB
BAROMETRIC PRESSURE 29.30

TEST DATE 07-18-93 supt
TEST NO. N-20-MM5-718
NOZZLE (SIZE,#) 0.448 #G-37
STATIC PRESSURE +17.0" H2O
PORT DIRECTION Port #4

ORIFICE CORRECTION (ΔH@) 1.572
METER CORRECTION (Y) 1.0153
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. THREE

HOT/COLD BOX NO. 8
PROBE NO. 13-1
FILTER NO. unweighed
STACK DIA.
PORT SIZE 3" "

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
105.0"	14:40	569.549	.095	1.62	1.62	107	99	5.0	673	725 °F	68 °F 4261	250 °F	30 min./point
			.095	1.62	1.62	107	99	5.0	673				
			.10	1.71	1.71	113	99	5.5	672				
75"			.10	1.71	1.71	116	100	5.5	671				
			.10	1.71	1.71	119	102	5.5	685				
			.10	1.70	1.71	119	102	5.5	685				
			.10	1.71	1.71	121	103	5.5	686				
			.10	1.71	1.71	122	105	5.5	686				
			.10	1.71	1.71	123	105	5.5	688		2065		
45"			.11	1.74	1.74	123	107	6.0	693				
			.11	1.74	1.74	124	107	6.0	690				
			.11	1.74	1.74	123	108	6.0	690				
			.11	1.74	1.74	123	108	6.0	682				
			.11	1.74	1.74	123	107	6.6	686				
			.11	1.74	1.74	123	108	6.0	687				
15"			.04	.63	.63	123	109	3.0	687				Estimates:
			.04	.63	.63	120	107	3.0	690				MW= 29.2
			.03	.47	.47	118	107	2.5	690				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01cfm
After	7.5	<0.02cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C020-01
TEST CREW RC, DB
BAROMETRIC PRESSURE 29.30

TEST DATE 07-18-93 (Sun)
TEST NO. N-20-MMS-718
NOZZLE (SIZE,#) 0.449 6-37
STATIC PRESSURE + 17.0" H2O
PORT DIRECTION Port #4

ORIFICE CORRECTION (ΔH@) 1.572
METER CORRECTION (Y) 1.052
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Three

HOT/COLD BOX NO. 8
PROBE NO. 12-1
FILTER NO. Changing
STACK DIA.
PORT SIZE 3"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
15"			.03	.47	.47	119	107	3.0	690	~250	68	~250	30 min./point
			.03	.47	.47	118	107	3.0	690				
			.04	.63	.63	118	107	3.5	690		3 hrs		
45"	45"		.10	1.58	1.58	121	107	6.5	689			*	missing last
			.10	1.58	1.50	122	107	6.5	689				set of readings
			.10	1.58	1.58	122	107	6.5	685				at 17:38
			.10	1.58	1.58	123	107	6.5	688				should be one line
			.11	1.74	1.74	125	108	6.5	689				
			.11	1.74	1.74	124	108	6.5	688				
75"	75"		.10	1.58	1.58	123	109	6.0	687				
			.10	1.58	1.58	124	109	6.0	686				Changed filter at
			.10	1.58	1.58	124	110	6.0	686				17:38
			.10	1.58	1.58	125	109	6.0	687				Started again
			.10	1.58	1.58	126	109	6.0	686				at 17:55
			.10	1.58	1.58	123	110	8.0	688		4 hrs		
105"	105"		.10	1.58	1.58	121	110	9.0	676				Estimates:
	17:38	686.900	.10	1.58	1.58	121	111	12.0	671	*			MW= 29.2
	1255	686.900	.10	1.58	1.58	120	111	4.5	681				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-18-93 (Sun)	ORIFICE CORRECTION (ΔH@)	1.572	HOT/COLD BOX NO.	8
TEST UNIT	SCR Reactor outlet	TEST NO.	N-20-MM5-718	METER CORRECTION (Y)	1.015	PROBE NO.	13-1
PROJECT NO.	93C028-01	NOZZLE (SIZE, ID)	0.448 #G-18	CALIBRATION DATE	07-02-93	FILTER NO.	[illegible]
TEST CREW	R/C, AB	STATIC PRESSURE	+17.0" H_2O	PITOT CORRECTION	0.84	STACK DIA.	
BAROMETRIC PRESSURE	29.30	PORT DIRECTION	Port #4	CONTROL BOX NO.	Three	PORT SIZE	36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
105"			.10	1.58	1.58	118	107	4.8	673	~280°F	<68°F	~280°	30 min./point
			.10	1.58	1.58	122	107	6.0	672				
75"			.10	1.58	1.58	122	107	5.0	684				
			.10	1.58	1.58	121	108	5.0	685				
			.10	1.58	1.58	122	109	5.0	686				
			.10	1.58	1.58	122	107	5.0	687				
			.10	1.58	1.58	121	107	5.5	687				
			.10	1.58	1.58	121	107	5.5	685				
45			.095	1.50	1.50	122	108	6.0	686				
			.095	1.50	1.50	121	108	6.0	686				
			.095	1.50	1.50	121	108	6.5	686				
			.095	1.50	1.50	121	108	6.5	687				
			.095	1.50	1.50	120	107	8.5	689				
			.095	1.50	1.50	120	107	9.0	688				
15.0			.03	.47	.47	120	107	5.5	689				
			.03	.47	.47	116	106	5.5	689				Estimates:
			.03	.47	.47	116	105	5.5	689				MW= 29.2
			.03	.47	.47	115	106	6.5	688				%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT	Battelle/DOE	TEST DATE	07-18-93 (SUN)	ORIFICE CORRECTION (ΔH@)	1.572	HOT/COLD BOX NO.	2
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-MMS-718	METER CORRECTION (Y)	1.052	PROBE NO.	13-1
PROJECT NO.	93C028-01	NOZZLE (SIZE,#)	0.148 #G-18	CALIBRATION DATE	07-02-93	FILTER NO.	[illegible]
TEST CREW	LPC DB	STATIC PRESSURE	+17.0" H2O	PITOT CORRECTION	0.84	STACK DIA.	
BAROMETRIC PRESSURE	29.30	PORT DIRECTION	Port #1	CONTROL BOX NO.	THBGC	PORT SIZE	36'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
15"			.03	.47	.47	115	105	7.5	690	~250	<68°F	~250°F	30 min./point
	19:40	746.650	.05	.47	.47	115	105	8.0	699				
	Δ = 6 hr = 360 min	Δ = 217.578 dcf	$(\Delta P)_{avg}$ = 0.075	$(\Delta H)_{avg}$ =	1.26	$(T_{meter})_{avg}$ = 110°F			$(T_{stack})_{avg}$ = 672°F				
									velocity = 22.2 ft/sec				
									%I = 88.4%				
													Estimates:
													MW = 29.2
													%H2O = 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-18-93 (Sun.)	ORIFICE CORRECTION (ΔH@) 1.734	HOT/COLD BOX NO. 4,4,3A
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MM5-718	METER CORRECTION (Y) 0.9832	PROBE NO. 10-3
PROJECT NO. 93C628-01	NOZZLE (SIZE,#) 0.197 #G18	CALIBRATION DATE 5-27-93	FILTER NO.
TEST CREW JPS TM	STATIC PRESSURE 0.9" H2O	PITOT CORRECTION 0.84	STACK DIA. 50"(depth) x
BAROMETRIC PRESSURE 29.30	PORT DIRECTION A	CONTROL BOX NO. 5	PORT SIZE 99"(width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
46.4	1015	957.098	0.8	0.89	0.89	81	75	4.5	194	~250°F	<68°F	~250°F	13 min./point
			0.8	0.90	0.90	88	77	4.5	195				
39.3	1028		0.9	1.01	1.01	95	82	6.5	195				Readings every
			0.9	1.02	1.02	98	85	6.5	195				6.5 min.
32.1	1041		1.0	1.14	1.14	104	90	7.0	195				
			1.0	1.16	1.16	106	93	7.0	195				
25.0	1054		1.0	1.16	1.16	110	96	7.0	198				
			1.0	1.16	1.16	111	98	7.0	198				
17.9	1107 1109		1.0	1.16	1.16	108	104	7.0	194			←	Lost power 1109
	1134		1.0	1.16	1.16	110	104	7.0	193				Restart 1134
10.7	1145		1.2	1.42	1.42	114	103	9.0	193				Down 25 min
			1.2	1.42	1.42	116	105	9.0	193				
3.6	1158		1.0	1.18	1.18	117	106	7.5	190				
	1211	1013.923	1.0	1.18	1.18	118	107	7.5	190				
		↑											Estimates:
		= 0.57 dcfm											MW = 29.2
													%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	9.0	0.005

TIME = 91 min
VOLUME = 56.825 dcf
$(\Delta P)_{AVG} = 1.0$

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After	OK	O

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

($T_{rake\ leg}$ = 100°F)

Actual Moisture = 4.9%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	XAD-2 + condensate	1426.6	1269.1	157.5
2.	Empty	440.9	425.8	15.1
3.	100 mL D.I. H2O	491.3	501.7	-10.4
4.	100 mL D.I. H2O	552.2	537.2	15.0
5.	Silica Gel	722.4	675.9	46.5

223.7 g total
AQE 6/93

velocity = 62.7 ft/sec
ISO. = 98.5%

Cracked coil condenser

1.802
0.961

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-18-93 (Sun)	ORIFICE CORRECTION (ΔH@) 1.774	HOT/COLD BOX NO. 4,4,3A
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MM5-718	METER CORRECTION (Y) 0.9832	PROBE NO. 10-3
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.197 #618	CALIBRATION DATE 5-17-93	FILTER NO.
TEST CREW JB, TM	STATIC PRESSURE 0.9" H2O	PITOT CORRECTION 0.84	STACK DIA. 50" (depth) ×
BAROMETRIC PRESSURE 29.30	PORT DIRECTION B	CONTROL BOX NO. 5 + 7	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
46.4	1226	1014.081	0.8	0.94	0.94	113	110	7.0	195	~250F	48F	~250°F	13 min./point
			0.8	0.94	0.94	117	109	7.0	196				
39.3	1239		1.0	1.19	1.19	119	109	8.5	197				Readings every
			1.0	1.19	1.19	119	108	8.0	197			6.5	min
32.1	1252		1.0	1.19	1.19	120	110	8.0	197				
			1.0	1.19	1.19	120	110	8.0	197				
25.0	1305 1317		1.0	1.19	1.19	115	110	8.0	200				stop at 1305 -
			1.0	1.19	1.19	118	110	9.0	200				plant delay
17.9	1330 1347		1.0	1.19	1.19	111	108	8.0	198				Restart 1317
			1.0	1.19	1.19	116	108	8.0	198				Down 12 min
10.7	1400 1411		0.6	0.71	0.71	117	108	5.5	198				Lost power and
	1446		0.6	0.71	0.71	118	108	5.5	197				Plant delay - stop at
3.6	~~1448~~ 1450		0.5	0.59	0.59	107	111	6.0	196	← control box #5 dead			1330 - Restart 1347
	1456	1063.870											Down 17 min
											switched to		
	1515	530.535	0.40	0.47	0.47	100	90	6.0	198	← control box #7			Estimates:
											ΔH@ = 1.802		MW= 29.2
	1522	533.242	0.40	0.47	0.47	105	95	6.0	198		Y = 0.9619		%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	9.0	0.005
After	[illegible]	

TIME = 84 min
VOLUME = 49.789 dcf
$(\Delta P)_{ave}$ = 0.9
$(\Delta H)_{ave}$ = 1.03

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

$T_{stack,ave}$ = 113°F

from 1515 to 1522
velocity = 39.8 ft/sec
ISO = 95.4%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

LOST POWER at 1456 - RESTART 1515
Down 19 min

velocity = 59.6 ft/sec
ISO = 96.6%

Lost Power 1448 - Restart 1450

AQE 6/92

Plant delay stop at 1411 - Restart 1440 - Lost Power at 1440 - Restart 1446

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

1.802
0.9619

CLIENT Battelle / DOE	TEST DATE 7-12-93 (Sun)	ORIFICE CORRECTION (ΔH@)	HOT/COLD BOX NO. 44,34
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MM5-718	METER CORRECTION (Y)	PROBE NO. 10-3
PROJECT NO. 93 CB 28-01	NOZZLE (SIZE,#) 0.197 #618	CALIBRATION DATE 5-17-93	FILTER NO.
TEST CREW JPS, TM	STATIC PRESSURE 0.9" H_2O	PITOT CORRECTION 0.84	STACK DIA. 50' (width) ×
BAROMETRIC PRESSURE 29.30	PORT DIRECTION C	CONTROL BOX NO. 7	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
46.4	1534	533.242	0.80	0.96	0.96	100	92	11.0	198			~250°F	13 min./point
			0.85	1.02	1.02	116	92	10.0	199	~200°F	<68°F		
39.3	1547		0.95	1.14	1.14	117	94	13.0	198				Readings every
			0.95	1.14	1.14	118	94	10.5	197				6.5 min
32.1	1600		1.15	1.39	1.39	120	96	13.0	198				
			1.20	1.45	1.45	120	96	13.5	198				
25.0	[illegible]		1.35	1.64	1.64	120	97	15.0	199				
			1.35	1.64	1.64	120	98	15.0	199				
17.9	1626		1.30	1.58	1.58	120	99	15.0	199				
			1.30	1.58	1.58	120	100	15.0	198				
10.7	1639		1.25	1.52	1.52	121	100	14.5	197				
			1.25	1.52	1.52	122	100	14.5	197				
3.6	1652		0.90	1.10	1.10	122	100	11.0	197				
	1705	596.975	0.90	1.10	1.10	124	100	11.0	196				
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	15.0	0.015

TIME = 91 min
VOLUME = 63.733 dcf
$(\Delta P)_{AVG}$ = 1.10
... 132

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

$(T_{stack})_{AVG}$ = 111°F

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Velocity = 66.0 ft/sec
ISO. = 101.4%

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

1.802 0.9619

Page 4 of 4

CLIENT	Battelle / DE	TEST DATE	7-18-93 (Sun)	ORIFICE CORRECTION (ΔH@)	~~[illegible]~~ 1.802
TEST UNIT	SNOX Tower Outlet	TEST NO.	N-21-MM5-718	METER CORRECTION (Y)	~~[illegible]~~ 0.9619
PROJECT NO.	93 C0822-01	NOZZLE (SIZE,#)	0.197 #G18	CALIBRATION DATE	5-27-93
TEST CREW	JTS, TM	STATIC PRESSURE	0.9" H_2O	PITOT CORRECTION	0.84
BAROMETRIC PRESSURE	29.30	PORT DIRECTION	D	CONTROL BOX NO.	7

HOT/COLD BOX NO.	4, 4, 3A
PROBE NO.	10-3
FILTER NO.	
STACK DIA.	50" (depth) x
PORT SIZE	99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
46.4	1754	597.492	0.85	1.02	1.02	106	98	12.0	198	~250°F	68°F	~200°F	13 min./point
			0.85	1.02	1.02	116	98	12.0	198				
39.3	1807		0.85	1.02	1.02	118	98	12.0	198				Readings every
			0.85	1.03	1.03	120	98	12.0	198				6.5 min
32.1	1820		1.10	1.34	1.34	120	98	13.0	199				
			1.10	1.34	1.34	120	98	14.0	197				
25.0	1833		1.00	1.22	1.22	120	99	13.5	198				
			1.05	1.28	1.28	120	99	13.5	198				
17.9	1846		1.15	1.40	1.40	119	99	13.0	198				
			1.10	1.34	1.34	118	98	14.0	198				
10.7	1859		1.20	1.46	1.46	118	98	15.5	198				
			1.15	1.40	1.40	116	98	14.5	198				
3.6	1912		0.85	1.02	1.02	118	99	12.5	198				
	~~[illegible]~~	658.791	0.90	1.10	1.10	118	99	13.0	198				
	~~[illegible]~~												
	1925												Estimates:
			(658.791 - 597.492) - (0.050 - 0.020)(91)					= 61.299 - (0.030)(91)					MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	15.0	0.015
After	15.0	0.050

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.		~~1426.6~~	~~1269.1~~	
2.				
3.				
4.				
5.				

TIME = 91 min

VOLUME = 58.569 dcf

$(\Delta P)_{AVG} = 1.00$

$(\Delta H)_{AVG} = 1.21$

$(T_{meter})_{AVG} = 108°F$

$(T_{...}) ...$ [illegible]

Velocity = 62.9 ft/sec

Iso. = 98.2%

AQE 6/92

Page #1

PARTICULATE ELD DATA

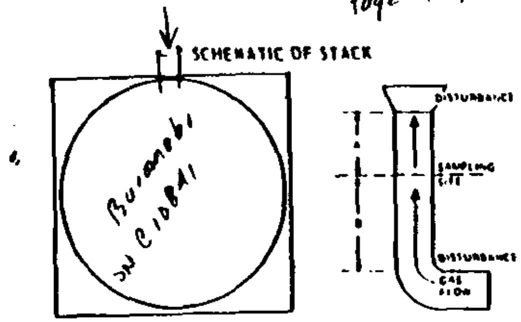
N-18-MMS-721

PLANT Niles
DATE 7-28-93
LOCATION BH (N #18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 3 Organic
SAMPLE BOX NO
METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 29.17
ASSUMED MOISTURE, %
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

SCHEMATIC OF STACK



CROSS SECTION

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER (101)	SAMPLING TIME (θ), min	STATIC PRESSURE (in. H_2O) (Time)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F (#6)	OUTLET ($T_{m_{out}}$), °F (#7)	SAMPLE BOX TEMPERATURE °F (#3)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F (Flex #8)	Probe #2	PUMP VACUUM in. Hg gauge	VELOCITY fps (KA0-2)
	0	13:23						~~336.60~~							
1								417.710							
2															
3	24		388	.35		.48	.48		107	106	245	252	254	4 1/2	45
4	32	13:45	~~346~~ 401	.50	4.2	.68	.68	427.3						6 1/2	
5	40		395	.65	3.7	.90	.90	431.2	107	104	244	253	255		
6	48	14:11	399	.70		.96	.96							8 1/2	43
7	56		401	0.80	4.0	1.1	1.1	440.1	110	109	246	259	252	10-	
8	4		394	0.83		1.15	1.15	445.6							52
9	12	14:34	398	.93	4.4	1.28	1.28	449.9	108	109	245	252	257	12 1/2	
10	20		398	.98		1.35	1.35	455.0							
11	28			1.0		1.4	1.4	460.4	102	100	244	252	258	15 1/2	
12	36			1.0		1.4	1.4								
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

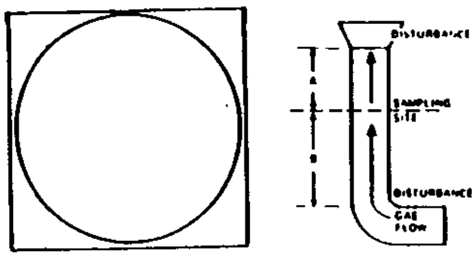
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Pre leak check .01 cfm at 17" Hg
Pt 1,2 no flow indication

#2

PARTICULATE "ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 7-21-93
LOCATION BH IN 18
OPERATOR Webb/Cox
STACK NO.
RUN NO. 3 Organic
SAMPLE BOX NO
METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 29.17
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		/
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in. H₂O)~~	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	0.2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	Flex TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	Probe	PUMP VACUUM in. Hg gauge	XAD-2 ~~VELOCITY fps~~
												#8	#2		
13	44		393	1.0		1.4	1.4	479.0	100	97	244			18	
14	52	15:13	394	1.0	4.5	1.2	1.9								
15	60		399	.98		1.35	1.35	483.2	79	95	242	251	259	19	38
16	8	15:30	404	.90		1.1	1.22								
17	16		404	.85		1.05	1.05	493.6	99	95	244	252	261	20	
18	24	15:45	406	.85	4.8	1.05	1.05	498.0							
19	32		410	.80		1.05	1.1	503.0	96	93	244	253	261	20½	41
20	40		408	.75	4.1	0.9	1.05	510 -						22	
21	48		414	.65		.90	.90	518.1	93	92	244	250	261	23	
22	56	*													
23	4		413	.50	6.5	.68	.68	523.3	72	91	243	251	262	20½	41
(2) 23 ~~24~~	12	16:33	407	.53		.72	.72	529.494	STOP						
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS * Apparent rumble on sampling platform - Stack gas temp dropped to ~340 for ~10-20 seconds

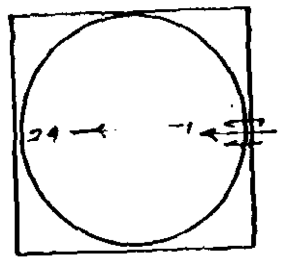
(2) Run 23 for 16 min pt 24 too close to duct wall

Filter change - drain condensate?

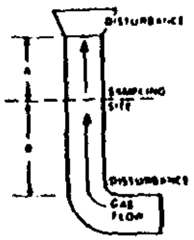
#3

PARTICULATE ' ELD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT Niles
DATE 7-21-93
LOCATION BH IN #18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 3 Organic
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.17
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Side TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE~~ (P_s), in. H_2O	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	Flex #1 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	Probe #2	PUMP VACUUM in. Hg gauge	XAD ~~VELOCITY~~
	0	5:43						530.0							
1	✓														
2	16	18:07													
3	24		~~237~~ 310	.45	4.8	.60	.60		92	89	243	254	252	5	42
4	32	18:15	376	.62	4.5	.85	.85	540.9							
5	40	18:23	315	0.72		1.0	1.0	545.7	95	90	245	252	251	6	40
6	48		375	0.79		1.02	1.02	554.5							
7	56		372	0.80		1.1	1.1	·	96	90	244	251	253		
8	4		372	0.86		1.2	1.2	560.1						11	38
9	12	18:55	310	.88	4.4	1.21	1.21	566.0	94	88	245	248	252		
10	20		371	0.90		1.22	1.22	570.8							
11	28		375	0.98	4.6	1.38	1.38	576.5	95	89	245	250	254	14.72	
12	36		380	1.1		1.5	1.5	582.1							
								587.0							
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

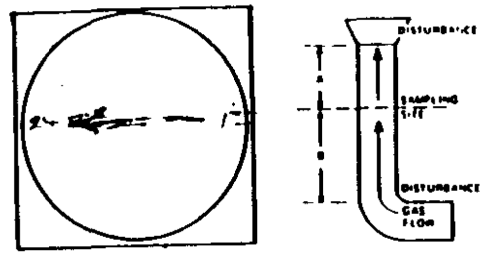
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Pt 1-2 - no flow indicated; run pt 3 for 24 min
Static = -2.2 "H_2O

#4

PARTICULATE 'ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Miller
DATE 7-21-93
LOCATION BH IN /#18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 3 Organic
SAMPLE BOX NO
METER BOX NO. K-40513

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.17
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

Side TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in. H₂O)~~	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	Ckg Whale TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F #1	#2	PUMP VACUUM in. Hg gauge	XAD-2 VELOCITY
13	44	*	393	1.1		1.5	1.5	587.4	96	90	245	249	254	15	40
14	52	19:35	∠												
15	60	19 –	405	.94		1.3	1.3	599.3	94	88	244	248	256	15	42
16	8		405	.90		1.22	1.22								
17	16	19:59	411	.85		1.19	1.19		90	86	244	247	256		44
18	24		423	.82		1.1	1.1								
19	32		423	.82		1.1	1.1	618.8	87	82	244	246	258	15½	53
20	40	20:23	419	.78		1.05	1.05	623.5							
21	48		425	.74	3.9	1.0	1.0	629.0	85	80	292	247	259	15½	57
22	56		426	.75		1.0	1.0	638.0							43
23	4	20:47	430	.69		.93	.93								
24	12	20:55	427	.68		.92	0.92	[illegible]	85	80	244	250	262	16	40
								645.400							
								417.710							
TOTAL								227.690							
AVERAGE															

Post leak Check .015 at 11"Hg with probe at 90° nil

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS
- O_2 high? checked Zero ck, Ambient ck, set 21.0
- Check O_2 directly from stack 3.9
- previously using gas meter outlet

NOMOGRAPH DATA

PLANT Niles, Ohio, SNOX process

DATE July 20, 1993

SAMPLING LOCATION outlet of baghouse

N-19-MM5-720

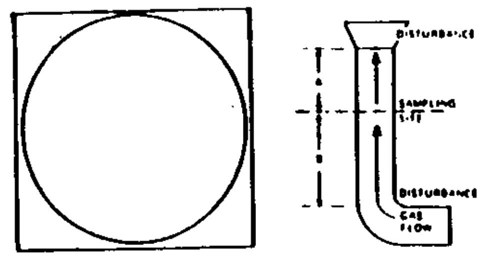
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg (P_m ±0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	6.0" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	380
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	1.20
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp, in. H_2O		0.85

EPA (Dur) 234
4/72

1

PARTICULATE "IELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOx proces
DATE 7/21/93
LOCATION outlet of baghouse
OPERATOR Leonard, Kurt
STACK NO.
RUN NO. N-19-MM5-721
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 75°F
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 880.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.63
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA[SH]
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H_2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % ~~VELOCITY~~
								~~79.099~~			outlet of filter				
1	0/13:08	236	368	0.28		0.60	0.60	82.747	85	85	202	246	63 ~~246~~	5.0	3.6
2	10/13:18	251	370	0.42		0.90	0.90	87.2	88	87	248	259	60	7.0	4.0
3	20/13:28	255	378	0.64		1.35	1.35	92.8	74	90	251	261	57	8.0	4.3
4	30/13:38	254	379	0.57		1.25	1.25	99.3	95	90	257	259	13" 58	8.0	4.0
5	[illegible]:45.5	257	383	0.77		1.65	1.66	104.3	77	92	256	259	9" 59	9.0	4.0
6	45/13:53	261	384	0.68		1.50	1.50	109.4	101	95	264	262	60	9.0	3.8
7	52.5/14:0[illegible]	259	384	0.62		1.30	1.30	114.8	102	95	257	262	61	9.5	4.2
8	60/14:08	262	384	0.65		1.40	1.40	120.3	102	96	255	261	19" 62	9.0	4.5
9	67.5/14:15.5	260	383	0.72		1.60	1.60	124.8	101	96	254	261	9" 61	9.5	4.0
10	75/14:23	259	383	0.60		1.25	1.25	130.1	103	97	256	261	63	9.0	4.3
11	82.5/14:30.5	258	384	0.52		1.15	1.15	135.4	102	97	257	261	23" 63	8.0	4.2
12	90/14:38	257	383	0.57		1.15	1.15	140.0	102	98	259	262	11" 64	8.0	4.6
13	97.5/14:45.5	283	384	0.89		1.90	1.90	144.8	102	97	238	262	63	10.0	4.6
14	105/14:53	339	384	0.91		2.00	2.00		104	99	229	264	64		
TOTAL															

AVERAGE

heated line 250°F

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

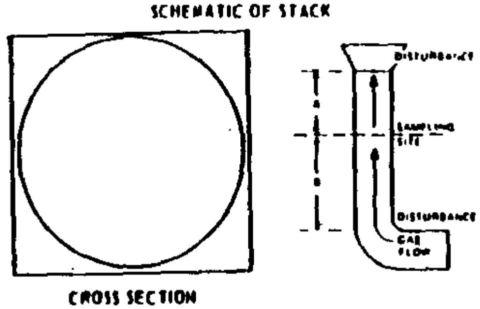
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



PLANT Niles, Ohio smox process AMBIENT TEMPERATURE 80° METER ΔH@ 1.65

DATE 7/21/93 BAROMETRIC PRESSURE 29.11 C FACTOR 0.90

LOCATION outlet bag house ASSUMED MOISTURE, % 7 PROCESS WEIGHT RATE ____

OPERATOR Leonard Hupp PROBE LENGTH, in. 9 ft.

STACK NO. ____ NOZZLE DIAMETER, in. 0.249

RUN NO. N-19-MM5-7d1 STACK DIAMETER, in. 8 ft.

SAMPLE BOX NO. 3 PROBE HEATER SETTING 250°F

METER BOX NO. X-40673 HEATER BOX SETTING 250°F

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	probe °F	SAMPLE BOX TEMPERATURE	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 %
15	1[illegible]/15:0[illegible]	372	384	0.70	1.50	1.60	156.1	103	98	220	264	64	9.7	4.5
16	[illegible]/15:08	381	383	0.76	1.65	1.65	161.9	103	98	221	263	66	9.8	4.6
17	[illegible]/15:15.5	380	384	0.57	1.25	1.26	167.1	103	98	216	264	[illegible] 66	8.8	4.2
18	135/15:23	381	384	0.54	1.15	1.15	172.3	105	100	213	268	69	8.1	4.7
19	142.5/15:[illegible]	380	383	0.45	0.96	0.96	176.6	103	99	210	262	65	7.5	4.4
20	150/15:38	381	384	0.40	0.86	0.86	180.9	103	100	209	261	66	7.0	4.5
21	157.5/15:[illegible]	381	384	0.33	0.70	0.70	184.9	104	100	204	262	66	6.8	4.3
22	165/15:53	380	383	0.29	0.60	0.60	188.6	104	100	200	261	66	6.6	4.3
23	172.5/16:0[illegible]	380	383	0.32	0.68	0.68	192.2	103	100	198	262	[illegible] 66	6.5	4.4
24	180/16:09	382	384	0.39	0.72	0.72	195.7	105	102	208	263	67	7.0	4.6
	187.5/16:[illegible]	off					199.366							
SIDE														
1	187.5/16:[illegible] on			0.17	0.37	0.37	199.366							
2	195/16:37	256	331	0.34	0.74	0.74	202.0	100	99	~~80~~	260	63	7.0	4.7
3	202.5/16:[illegible]	255	3	0.38	0.82	0.82	205.6	100	98	204	260	56	7.5	4.8
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

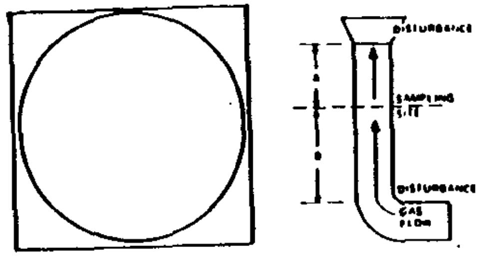
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#3

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE 7/21/93
LOCATION outlet of baghouse
OPERATOR Lenard, Hupp
STACK NO.
RUN NO. N-19-MM5-721
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 88°F
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8 ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F (STATIC PRESSURE (in. H_2O))	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	outlet of probe	SAMPLE BOX TEMPERATURE	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % velocity
4	210/16:48	256	379	0.44		0.94	0.94	209.6	103	100	218	262	58	8.0	4.4
5	2125/16:55	256	380	0.73		1.60	1.60	214.0	105	101		262	58	10.0	4.7
6	225/17:03	257	380	0.59		1.26	1.25	2	104	100	2274	262	56	9.8	4.7
7	2325/17:10	257	380	0.67		1.46	1.45	224.0	104	100	232	261	56	10.0	4.0
8	240/17:18	258	380	0.58		1.25	1.25	229.1	102	98	228	260	54	10.0	4.5
9	2425/17:25	262	380	0.56		1.20	1.20	234.1	104	99	224	261	56	10.0	4.4
10	255/17:33	263	381	0.64		1.35	1.35	239.3	105	100	223	261	57	10.0	4.5
11	2625/17:40	288	381	0.67		1.45	1.46	244.3	106	101	252	261	58	10.0	4.5
12	270/17:48	285	379	0.79		1.70	1.70	249.6	104	99	263	260	57	10.0	4.8
13	2775/17:55	296	382	0.89		1.85	1.85	254.9	106	102	263	263	59	11.5	4.6
14	285/18:03	349	382	0.88		1.85	1.86	260.7	108	103	234	264	60	11.5	4.5
15	2925/18:10	374	380	0.79		1.70	1.70		107	102	207	263	59	11.5	4.8
16	300/18:18	383	381	0.80		1.75	2.75		107	102	212	263	57	11.5	4.8
17	3025/18:25	384	381	0.74		1.60	1.60	278.0	106	101	205	260	55	11.0	4.4
18	315/18:33	393	380	0.67		1.45	1.45	284.0	108	103	215	262	56	10.6	4.4
TOTAL															
AVERAGE															

static pressure 8.6" H_2O

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

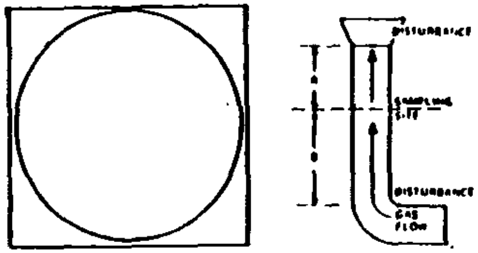
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE 7/21/93
LOCATION outlet of baghouse
OPERATOR Leonard, Hupp
STACK NO. ______
RUN NO. N-19-MM5-721
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 92°F
BAROMETRIC PRESSURE ______
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 840
PROBE HEATER SETTING 370°F
HEATER BOX SETTING 350°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp. ~~STATIC PRESSURE (in. H2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	set probe temp at 380°F SAMPLE BOX TEMPERATURE outlet of probe		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % velocity
19	322.5/[illegible]	392	381	0.90		1.90	1.90	288.9	109	104	213	263	57	10.5	5.1
20	330/18:48	392	379	0.84		1.80	1.80	294.4	106	102	[illegible] 229	261	58	10.5	5.0
21	337.5/18:5[illegible]	400	379	0.76		1.65	1.65	299.8	106	103	239	261	XAD-2 40 56		
22	345/19:03	399	379	0.74		1.60	1.60	305.1	104	101	240	260	56	10.7	5.1
23	352.5/19:10.5	400	380	0.63		1.40	1.40	310.5	104	100	242	262	56	10.7	5.0
24	360/19:18	400	379	0.41		0.88	0.88	315.7	104	100	240	262	56	8.0	5.0
	362.5/19:20.5	off						320.180							
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

leak check 0.025 cfm at 13.0" Hg

COMMENTS

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR [illegible]
BAROMETRIC PRESSURE 29.30

TEST DATE 7-28-93 (Wed.)
TEST NO. N-20-MM5-728
NOZZLE (SIZE,NO.) .411"
STATIC PRESSURE -0.0" H_2O
PORT DIRECTION Port #2

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Three

HOT BOX NO. 8
COLD BOX NO. 8
PROBE NO. 13-2
FILTER NO. [illegible]
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	1300	982.800	.04	.65	.65	86	84	2.0	631	280°F	68°F	~~[illegible]~~°F	15 min/pt
			.04	.65	.65	97	84	2.0	653			~300°F	
			.04	.65	.65	97	88	2.0	629				
90"			.04	.65	.65	101	89	2.0	630				
			.04	.65	.65	103	91	2.0	633				
			.04	.65	.65	105	93	2.0	655				
70"			-.04	.65	.65	107	94	2.0	628				
			.04	.65	.65	109	96	2.5	623				
			.04	.65	.65	110	97	2.5	623				
50"			.04	.65	.65	110	98	2.5	625				
			.04	.65	.65	112	98	2.5	636				
			.03	.49	.49	111	99	1.5	637				
30"			.03	.49	.49	112	98	1.5	657				
			.03	.48	.48	111	99	1.5	635				
			.03	.49	.49	112	99	1.5	636				Estimated:
10"			.03	.49	.49	112	100	1.5	652				MW=29.2
			.03	.49	.49	112	101	1.5	599				%H2O=9
	14:30	1022.858	.03	.49	.49	112	101	1.5	610				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.001 cfm
After	9.0	0.002 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	6.9 [illegible]	.02 [illegible]
After		

	1	2
CO2	14.0	14.3
O2	6.5	6.5
CO	0	0
N2	79.5	79.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	XAD-2 + Condensate	1539.4	1231.9	307.5
2.	Empty	379.3	375.2	4.1
3.	100 mL DI H_2O	551.9	552.2	-0.3
4.	100 mL DI H_2O	544.6	538.0	6.6
5.	200 g Silica Gel	709.5	671.2	38.2

Actual Moisture 8.3%

352.2 g total

0	0	X	0	0	0	0
7	6	X	4	3	2	1

FLOW ↓

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-21-93 (Wed)	ORIFICE CORRECTION	1.572	HOT BOX NO.	8
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-MM5-727	METER CORRECTION	1.0151	COLD BOX NO.	8
PROJECT NO.	93cd28-01	NOZZLE (SIZE,ft)	0.441	CALIBRATION DATE	07-02-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	RLC	STATIC PRESSURE	+70 "H2O	PITOT CORRECTION	0.84	FILTER NO.	Unassigned
BAROMETRIC PRESSURE	29.28	PORT DIRECTION	Port #3	CONTROL BOX NO.	THREE	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot Δ P (in. H2O)	Orifice Δ H Req'd. (in. H2O)	Orifice Δ H Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	14:37	1022.900	.04	.65	.65	106	99	2.0	645	~250°F	<68°F	~300°F	15 min/pt
			.04	.65	.65	108	99	2.0	645				
			.04	.65	.65	110	99	2.0	645				Run time 95 min
90"			.04	.65	.65	110	100	2.5	645				[illegible]
			.04	.65	.65	111	99	2.5	653				[illegible]
			.04	.65	.65	111	100	2.5	654				[illegible]
70"			.04	.65	.65	112	100	2.5	654				[illegible]
			.04	.65	.65	111	99	2.5	654				[illegible]
			.04	.65	.65	111	99	2.5	655				[illegible]
50"			.04	.65	.65	111	99	2.5	655				
			.04	.65	.65	111	100	3.0	652				
			.03	.49	.49	112	98	2.5	653				
30"			.03	.49	.49	110	99	3.0	653				
			.03	.49	.49	111	99	3.0	654				
			.03	.49	.49	110	98	3.0	653				Estimates:
10"			.03	.49	.49	111	98	3.0	653				MW= 29.2
			.03	.49	.49	111	98	3.0	635				%H2O= 9
	16:12	1067.975	.04	.65	.65	112	90	3.5	654				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.5	
CO	0	
N2	79.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle/Ddr
TEST UNIT Scr Gemma outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.28

TEST DATE 07-21-93 (Wed.)
TEST NO. N-20-MMS-721
NOZZLE (SIZE,I) 0.441
STATIC PRESSURE 17.0" H2O
PORT DIRECTION Port #4

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION .84
CONTROL BOX NO. THREE

HOT BOX NO. 8
COLD BOX NO. 8
PROBE NO. 13-2
FILTER NO. whatman glass
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	16:27	1067.977	.10	1.62	1.62	98	97	6.5	673	250°F	<68°	300°F	15 min/pt
			.10	1.62	1.62	111	98	6.5	673				15 minutes
			.10	1.62	1.62	113	99	6.5	673				total
90			.10	1.62	1.62	114	98	6.5	672				
			.10	1.62	1.62	114	99	6.5	679				
			.10	1.62	1.62	115	99	6.5	680				
70			.10	1.62	1.62	115	99	6.5	680				
			.10	1.62	1.62	114	99	7.0	682				
			.10	1.62	1.62	115	99	7.0	682				
60			.10	1.62	1.62	115	99	7.0	683				
			.11	1.78	1.78	116	99	8.0	685				
			.11	1.78	1.78	115	99	8.5	685				
30			.11	1.78	1.78	116	99	8.5	685				
			.11	1.78	1.78	115	100	8.5	689				
			.11	1.78	1.78	116	100	8.5	688				Estimates:
10			.05	.81	.81	113	100	4.5	682				MW= 29.2
	17:52	1128.790	.05	.81	.81	113	99	4.5	682				%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.5	
CO	0	
N2	79.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQB 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / POE	TEST DATE 07-21-93 (Wed.)	ORIFICE CORRECTION 1.572	HOT BOX NO. 8
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MM5-721	METER CORRECTION 1.0157	COLD BOX NO. 8
PROJECT NO. 93C928-01	NOZZLE (SIZE,#) 0.441	CALIBRATION DATE 07-03-93	PROBE NO. LS-2
CONTROL BOX OPERATOR [illegible]	STATIC PRESSURE 17.0" H2O	PITOT CORRECTION 0.84	FILTER NO. [illegible]
BAROMETRIC PRESSURE 29.28	PORT DIRECTION Port #6	CONTROL BOX NO. Three	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	18:21	1129.790	.05	.81	.81	97	95	5.0	683	~250	<68°F	~300°F	15 [illegible]
			.05	.81	.81	105	95	5.0	690				
			.05	.81	.81	107	95	4.5	690				
90			.06	.97	.97	108	96	4.5	693				
			.06	.97	.97	109	96	4.5	695				
			.07	1.13	1.13	110	96	5.0	695				
70			.05	.81	.81	111	97	4.5	696				
			.05	.81	.81	110	96	4.5	697				
			.05	.81	.81	110	97	4.5	698				
50			.06	.97	.97	111	96	4.5	698				
			.07	1.13	1.13	110	97	4.5	699				
			.06	.97	.97	111	96	4.5	700				
30			.06	.97	.97	111	96	4.5	699				
			.06	.97	.97	110	97	4.5	699				
			.06	.97	.97	110	96	4.5	698				Estimates:
10			.04	.65	.65	109	96	3.0	699				MW= 21.2
			.04	.65	.65	108	96	3.0	669				%H2O= 9.0
	9:59	1181.075	.04	.65	.65	108	96	3.0	650				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.5	
CO	0	
N2	79.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

TEST TOTALS

TIME = 360 min

VOLUME = 198.231 dcf

$(\Delta P)_{AVG} = 0.055$

$(\Delta H)_{AVG} = 0.90$

$(T_{meter})_{AVG} = 104°F$

$(T_{stack})_{AVG} = 662°F$

velocity = 18.9 ft/sec

ISO. ~97.7%

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C020-01
CONTROL BOX OPERATOR JTB, TM
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed.)
TEST NO. N-21-MM5-720
NOZZLE (SIZE,#) 0.197 918
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION A

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 4
COLD BOX NO. 443A
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1300	~~400.497~~ 439.340	0.8	0.90	0.90	90	86	4.0	200	~250°F	<68°F	~250°F	13 min/point
			0.8	0.90	0.90	98	88	5.0	196				
39.3	1313		0.8	0.90	0.90	103	90	5.0	199				Readings every
			0.8	0.92	0.92	105	92	5.0	199				6.5 minutes ✓
32.1	1326		1.0	1.15	1.15	108	95	6.5	197				
			1.0	1.15	1.15	110	97	7.5	197				
25.0	1339		1.1	1.27	1.27	112	100	7.5	199				
			1.1	1.27	1.27	113	101	8.0	199				
17.9	1352		1.1	1.27	1.27	114	103	8.0	198				
			1.1	1.27	1.27	115	103	6.5	199				
10.7	1405		1.2	1.40	1.40	115	105	10.0	199				
			1.2	1.40	1.40	114	104	10.0	199				
3.6	1418		1.2	1.40	1.40	115	105	8.0	199				
	1431	497.610	1.2	1.40	1.40	116	105	8.0	199				
													Estimates:
	Δ=91 min	Δ = 58.270 dcf	$(\Delta P)_{avg}$ = 1.0	$(\Delta H)_{avg}$ =	1.19	$(T_{meter})_{avg}$ = 103°F		$(T_{stack})_{avg}$ = 199°F					MW- 29.2
								Velocity = 63.0 ft/sec			ISO = 100.8%		%H2O- 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	16.0	0.005

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After		

	1	2
CO2	12.0	
O2	7.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	~~KOH~~ + condensate	1586.4	1276.2	310.2
2.	Empty	442.1	424.2	17.9
3.	100 mL D.I. H_2O	589.6	551.2	~~-90.5~~ 38.4
4.	100 mL D.I. H_2O	488.6	519.1	-30.5
5.	200 g Silica Gel	680.4	663.7	53.6

+36.9
717.3

389.6 g total

Actual Moisture = 8.0%

KEYSTONE

AQR 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C020-01
CONTROL BOX OPERATOR JTS, TM
BAROMETRIC PRESSURE 29.28

TEST DATE 7-28-93 (Wed.)
TEST NO. N-21-MM5-72
NOZZLE (SIZE,#) 0.197 @ 18
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION B

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 4
COLD BOX NO. 4-3A
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50" (depth) X 97" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1440	497.775	0.8	0.92	0.92	108	104	6.0	199	~250°F	68°F	~250°F	13 min/point
			0.8	0.92	0.92	110	102	6.5	199				
39.3	1453		1.0	1.17	1.17	111	102	7.0	199				Readings every 6.5 minutes
			1.0	1.17	1.17	112	102	7.0	199				
32.1	[illegible]		1.1	1.29	1.29	112	102	8.0	199				
			1.1	1.29	1.29	112	102	8.0	199				
25.0	1519		1.0	1.17	1.17	112	102	8.0	199				
			1.0	1.17	1.17	112	102	8.0	199				
17.9	[illegible]		1.0	1.17	1.17	113	103	8.0	197				
			1.0	1.17	1.17	113	103	8.0	197				
10.7	[illegible]		0.6	0.70	0.70	113	103	5.5	197				
			0.6	0.70	0.70	113	103	5.5	197				
3.6	[illegible]		0.5	0.59	0.59	113	104	4.0	197				
	1611	553.470	0.5	0.59	0.59	113	104	4.0	195				
													Estimates:
	θ = 91 min	Δ = 55.695 dcf	(ΔP)avg = 0.8	(ΔH)avg = 1.00		(Tmeter)avg = 107°F			(Tstack)avg = 198°F				MW = 29.2
													%H2O = 8.5

Velocity = 56.3 ft/sec I.S.O. = 106.9%

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	10.0	0.015

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	ok	ok
After		

	1	2
CO2	12.0	
O2	7.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQF 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle /DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 73C628-01
CONTROL BOX OPERATOR JB, TM
BAROMETRIC PRESSURE 29.28

TEST DATE 7-28-93 (Wed.)
TEST NO. N-21-MM5-7201
NOZZLE (SIZE,#) 0.197 @18
STATIC PRESSURE 0.8" H2O
PORT DIRECTION C

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 4
COLD BOX NO. 4734
PROBE NO. 10-3
FILTER NO.
STACK DIA. 5' (approx.) x 7' (actual)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1626	553.832	1.0	1.16	1.16	104	102	9.0	196	~250°F	68°F	~250°F	13 min/point
			1.0	1.16	1.16	107	102	9.0	197				
39.3	1637		1.0	1.16	1.16	109	100	9.0	196				Readings every
			1.0	1.16	1.16	109	100	9.0	195				6.5 minutes
32.1	1648		1.4	1.62	1.62	107	100	15.0	195				
			1.4	1.62	1.62	107	100	15.0	195				
25.0	1705		1.4	1.62	1.62	99	99	15.0	195				
			1.4	1.62	1.62	99	99	15.0	195				
17.9	1718		1.6	1.86	1.86	99	99	15.0	197				
			1.6	1.86	1.86	99	99	15.0	197				
10.7	1731		1.4	1.62	1.62	97	95	15.0	195				
			1.4	1.62	1.62	97	95	15.0	195				
3.6	1744		1.2	1.39	1.39	96	95	15.0	197				
	1757	608.300	1.2	1.39	1.39	96	95	15.0	195	←	changed	silica gel impinger dry	

θ = 91 min Δ = (608.300 − 553.832) − (0.050 − 0.020)(91) = 54.468 − 2.73 = 51.738 ft³

Estimates:
MW = 29.2
%H2O = 8.5

(ΔP)avg = 1.3 (ΔH)avg = 1.49 (T meter)avg = 100°F (T stack)avg = 196°F

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	18.0	[redacted] 0.050

↑ correct value ... for ...

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	12.0	
O2	7.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 71.6 ft/sec
I = 93.9%

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle /DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR JTS, TM
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed.)
TEST NO. N-21-MM5-72●1
NOZZLE (S.ZE, #) 0.197 G18
STATIC PRESSURE 0.8" H₂O
PORT DIRECTION D

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 4
COLD BOX NO. 4-34
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50" (depth) x 99 (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comment
46.4	1816	608.737	1.0	1.15	1.15	97	95	7.0	195	~250°F	48°F	~250°F	13 min/point
			1.0	1.15	1.15	103	95	7.0	195				
39.3	1829		1.3	1.50	1.50	107	96	8.0	195				Readings every
			1.5	1.73	1.73	109	96	10.0	194				6.5 minutes
32.1	1842		1.7	1.96	1.96	107	97	11.0	195				
			1.7	1.99	1.99	108	98	12.5	194				
25.0	1855		1.7	1.99	1.99	106	98	13.0	194				
			1.7	1.97	1.97	105	97	14.0	194				
17.9	1908		1.2	1.39	1.39	104	97	10.0	193				
			1.2	1.39	1.39	106	97	10.0	193				
10.7	1921		1.1	1.27	1.27	107	98	9.0	192				
			1.1	1.27	1.27	108	97	9.0	192				
3.6	1934	676.300	1.0	1.16	1.16	107	98	8.5	192				
	1947		0.8	0.93	0.93	108	97	7.0	191				
	Δ=91	Δ=67.563	$(\Delta p)_{avg}$ =	$(\Delta H)_{avg}$	=1.49	$(T_{meter})_{avg}$	=101°F	$(T_{stack})_{avg}$	= 194°F				Estimates:
	min												MW=29.2
			1.3					velocity	= 71.5 ft/sec				%H2O=8.5
								Bar. V	= 102.77				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	18.0	0.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	12.0	
O2	7.0	
CO	0	
N2	81.0	

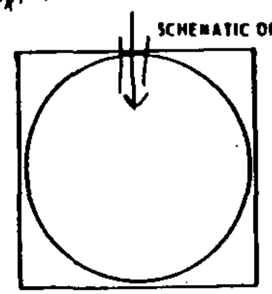
Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE [illegible]

#1

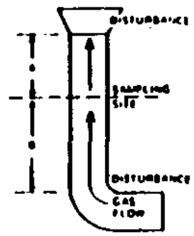
PARTICULATE 'ELD DATA

N-18-MM5-723



SCHEMATIC OF STACK

CROSS SECTION



PLANT Niles
DATE 7-29-93
LOCATION #18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 5 Organic
SAMPLE BOX NO. –
METER BOX NO. X-40513

AMBIENT TEMPERATURE 76
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. .215
STACK DIAMETER, in. 82
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

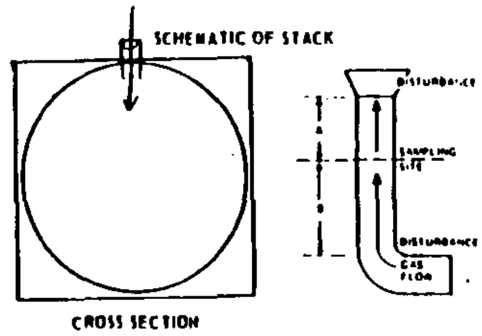
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	STATIC PRESSURE (in H₂O) End of sample period Time	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER (Seen on meter) INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Filter #1	Probe #2	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F #3 Filter	#9	PUMP VACUUM in. Hg gauge	XAD2 VELOCITY
	0	09:18						823.465								
1	no flow indication		350	.25	3.3	.35	.35		118	116	259	254	248	67	5	60
2	16	09:34														
3	24	09:42	394	.4		.55	.55	871-								
4	32	09:50	406	.48		.66	.66	874.9	130	127	261	257	253	68	7½	56
5	40	09:58	428	.57	2.5	.80	.80	878.6								
6	48	10:06	417	.70		.98	.98	882.9	137	136	264	259	256	73	10½	47
7	56	10:14	417	.72	2.7	1.05	1.05	887.7								
8	4	10:22	413	.75		1.11	1.11	893.1	144	141	267	260	256	79	12	43
9	12	10:30	412	.80	3.0	1.2	1.2	898.3								
10	20	10:38	408	.82		1.21	1.21	904.3	141	139	263	257	252	77	14	40
11	28	10:46	405	.85		1.25	1.25									
12	36	10:54	399	.95	2.9	1.4	1.4	914.8	126	127	256	251	242	72	18	
TOTAL																
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO₂	O₂	CO	N₂
1					
2					
3					
4					

COMMENTS

#2



PARTICULATE 'ELD DATA

PLANT Niles
DATE 7-23-93
LOCATION #18 BH IN
OPERATOR Webb/Cox
STACK NO. ____
RUN NO. 5 Organic
SAMPLE BOX NO. ____
METER BOX NO. X-40513

AMBIENT TEMPERATURE 87
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 8
PROBE LENGTH, in 96
NOZZLE DIAMETER, in 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE ____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	~~Time~~ MIN SAMPLING TIME (θ), min	Time STATIC PRESSURE (in. H2O)	#4 STACK TEMPERATURE (T_S), °F	VELOCITY HEAD (ΔP_S)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	Box SAMPLE ~~BOX~~ TEMPERATURE °F #1	Probe #2	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER #3 °F Filter	Imp	PUMP VACUUM in. Hg gauge	XAD-2
13	44	11:02	392	.9		1.3	1.3	920.3	116	116		253				
14	52	11:10	394	.82	3.0	1.2	1.2	925.2	111	110	248		245	63	19	39
15	60	11:18	403	.82		1.2	1.2	930.9								
16	8	11:26	398	.78		1.15	1.15	936.3	103	101	248	254	241	62	20	
17	16	11:34	402	.75	2.8	1.11	1.11	941.0								
18	24	11:42	404	.70		.98	.98	946.3	101	99	249	257	245	62	20	46
19	32	11:50	408	.69		.98	.98	951.3								
20	40	11:58	407	.60	2.9	.88	.88	955.0	99	76	250	262	244	63	19½	
21	~~48~~	12:06														
22			Frame in way of pitot tube connection													
23																
24	32	12:30	408	.3	2.9			961.5	97	95	253	252	245	69	12	54
		12:32	Stop					974.432								
								974.50	aft. leak check							
TOTAL																
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

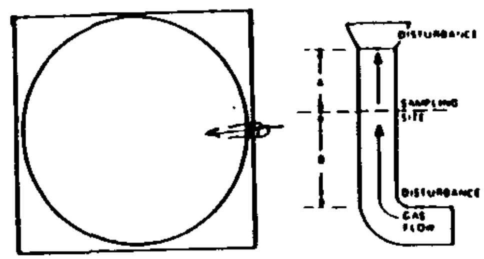
COMMENTS • Filter change and condensate from 1st Impinger collected
Leak check = .025 at 20"Hg

#3

PARTICULATE 'ELD DATA

14:50 → Fed. DOE Pittsburg → Mildred Perry DOE

SCHEMATIC OF STACK



CROSS SECTION

PLANT	Niles	AMBIENT TEMPERATURE	80	METER ΔH@	1.64
DATE	7 23-93	BAROMETRIC PRESSURE	29.16	C FACTOR	0.90
LOCATION	#18 BH IN	ASSUMED MOISTURE, %	8	PROCESS WEIGHT RATE	
OPERATOR	Webb/Cox	PROBE LENGTH, in.	96		
STACK NO.		NOZZLE DIAMETER, in.	0.215		
RUN NO.	5 Organic	STACK DIAMETER, in.	80		
SAMPLE BOX NO.		PROBE HEATER SETTING	250		
METER BOX NO.	X40513	HEATER BOX SETTING	250		

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

Side TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time STATIC PRESSURE (in. H_2O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	Plot SAMPLE BOX TEMPERATURE, °F #1	Probe #2	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F #3	#9	PUMP VACUUM in. Hg gauge	XAD-2 VELOCITY fps
	0	13:25						~~974.48~~	Leak checked volume		#1	#2	6.1k	#9		
1	~							974.50								
2	16	13:41	~~142~~?	.28		0.3	0.3		95	95	254	~~65~~	246	65	3	52
3	24	13:49	345	.50	2.7	.72	.72	980.6								
4	32	13:57	366	.60		.88	.88	985.1	105	99	255	252	246	59	8	40
5	40	14:05	367	.68	2.7	1.0	1.0	989.0								
6	48	14:13	366	.75		1.12	1.12									
7	56	14:21	369	.78		1.15	1.15	998.7	108	101	252	250	246	61	11½	39
8	4	14:29	366	.88	2.8	1.30	1.30	1004.6								
9	12	14:37	368	.90		1.30	1.30	9.5	111	103	252	252	246	64	13	
10	20	14:45	374	.98		1.4	1.45	16.2								
11	28	14:53	382	1.05	2.8	1.4	1.5	22.5	112	106	251	252	246	68	18½	38
12	36	15:01	386	1.05		1.4	1.5	25.6								
13																
TOTAL																
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

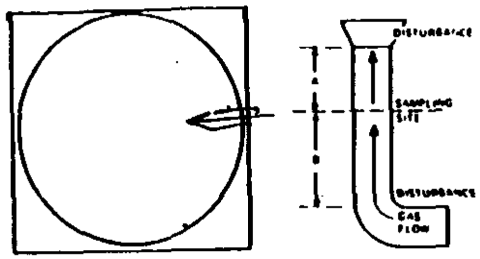
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Nilo
DATE 7-23-93
LOCATION #78 BHW
OPERATOR Webb / E. Cop
STACK NO.
RUN NO. 5 Organic
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Filter	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F		PUMP VACUUM in. Hg gauge	XAD-2 VELOCITY
								1000+			#1	#2	#3 Filter	#4		
13	44	15:09	393	1.0	3.0	1.4	1.5	32.0	110	105	251	254	246	69	20	38
14	52	15:17	402	.95		1.4	1.4	37.7								
15	60	15:25	414	.90	2.7	1.3	1.3	43.1	108	103	249	255	246	70	21	40
16	8	15:33	422	.85		1.25	1.25	48.6								
17	16	15:41	424	.85	2.4	1.25	1.25	53.0	106	103	250	258	245	71	21 1/2	44
18	24	15:49	421	.82		1.2	1.2	59.7								
19	32	15:57	423	.80		1.18	1.18	64.8	106	103	250	257	245	73	23	49
20	40	16:05	424	.80	2.9	1.0	1.18	69.0								
21	48	16:13	432	.75		1.0	1.1	76.5	103	102	249	259	244	59	22 1/2	36
22	56	16:21	435	.70	2.6	1.0	1.0	79.9								
23	4	16:29	435	.60		.88	.88	85.3	102	101	250	261	246	60	21 1/2	39
24	12	16:37	432	.53	2.7	.76	.76	89.7	STOP						19	
		~~16:45~~						93.33								
TOTAL	384	384														
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Post leak check at 23" Hg .035 cfm with flex line with s/s at 7" .02 cfm

NOMOGRAPH DATA

PLANT Niles, Ohio SNOX process

DATE July 23, 1993

SAMPLING LOCATION outlet of bag house

N-19-MM5-723

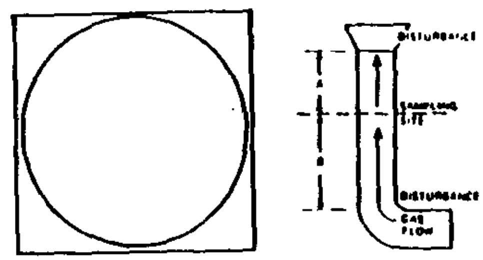
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	110 ~~89~~
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.16
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	382
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	0.96
C FACTOR	0.90	
CALCULATED NOZZLE DIAMETER, in.	0.260	
ACTUAL NOZZLE DIAMETER, in.	0.247	
REFERENCE Δp, in. H_2O	0.85	

EPA (Dur) 234
4/72

#1

PARTICULATE "ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT	Niles, Ohio ...	AMBIENT TEMPERATURE	75	METER ΔH@	1.65
DATE	7/23/93	BAROMETRIC PRESSURE	29.16	C FACTOR	0.90
LOCATION	outlet of baghouse	ASSUMED MOISTURE, %	7	PROCESS WEIGHT RATE	
OPERATOR	Leonard, Hupp	PROBE LENGTH, in.	9 ft. glass		
STACK NO.		NOZZLE DIAMETER, in.	0.247		
RUN NO.	N-19-MM5-723	STACK DIAMETER, in.	8 ft.		
SAMPLE BOX NO.	3	PROBE HEATER SETTING	250°F		
METER BOX NO.	N-40573	HEATER BOX SETTING	250°F		

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA...
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp ~~STATIC PRESSURE (in Hg)~~	STACK TEMPERATURE (T_S), °F	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 %
1	0/9:01	246	342	0.39	0.82	0.82	631.177	67	66	260	54	7.5	3.7
2	7.5/9:08.5	259	375	0.54	1.15	1.15	635.1	71	67	260	53	8.5	3.5
3	15/9:16	246	382	0.54	1.15	1.15	639.6	75	69	261	52	8.6	3.7
4	22.5/9:23.5	251	384	0.57	1.20	1.20	644.0	80	73	262	XAD-7 40 55	9.0	3.7
5	30/9:31	248	384	0.59	1.25	1.25	648.7	83	75	261	54	9.0	3.8
6	37.5/9:38.5	248	385	0.66	1.40	1.40	653.3	86	77	262	56	9.8	3.8
7	45/9:46	254	386	0.63	1.35	1.35	658.2	87	79	262	55	9.8	3.5
8	52.5/9:53.5	253	386	0.57	1.20	1.20	663.2	89	82	261	56	9.5	3.8
9	60/10:01	255	383	0.57	1.20	1.20	668.0	91	85	262	57	9.5	3.8
10	67.5/10:08.5	250	383	0.54	1.15	1.15	672.6	92	86	262	57	9.5	4.0
11	75/10:16	254	384	0.51	1.10	1.10	677.8	93	87	261	XAD-7 40 57	9.0	3.6
12	82.5/10:23.5	249	384	0.53	1.10	1.10	682.0	94	88	258	57	9.0	4.0
13	90/10:31	255	385	0.88	1.90	1.90	686.6	96	90	263	58	12.0	3.9
14	97.5/10:38.5	252	384	0.76	1.70	1.70	692.3	98	91	262	54	11.5	4.0
15	105/10:46	256	385	0.89	1.90	1.90	697.8	99	93	262	53	12.0	4.0
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

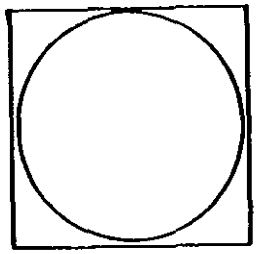
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

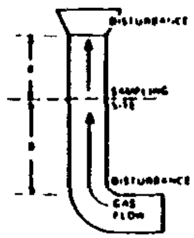
#2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT Niles, Ohio SNOX process
DATE 7/23/93
LOCATION outlet of baghouse
OPERATOR Leonard, Hure
STACK NO
RUN NO. N-19-MM5-723
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 880
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F / STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % (VELOCI... fps)
16	112.5/10:52.5	254	384	0.89	1.90	1.90	703.7	99	93	260	50	12.0	3.9
17	120/11:01	255	385	0.80	1.70	1.70	709.5	99	93	[illegible] 41 261	50	11.8	4.0
18	127.5/11:08.5	257	385	0.72	1.50	1.50	715.2	100	95	261	51	10.6	4.0
19	135/11:16	251	385	0.61	1.30	1.30	720.6	100	95	261	51	10.0	3.8
20	142.5/11:24	252	385	0.69	1.40	1.40	725.7	101	95	260	51	10.0	3.9
21	150/11:31	255	384	0.44	0.94	0.94	730.6	102	97	262	52	8.7	4.0
22	152.5/11:38	248	384	0.37	0.80	0.80	735.2	102	97	[illegible] 40 261	54	7.8	4.2
23	165/11:46	250	384	0.34	0.74	0.74	739.0	101	97	261	54	7.6	4.0
24	172.5/11:53	249	385	0.34	0.74	0.74	742.8	101	98	261	54	7.6	4.0
	180/12:01	off.		0.			746.622						
SIDE													
1	180/12:49	on	324	0.23	0.50	0.50	746.628	97	97	261	57	7.2	4.1
2	187.5/12:22	262	352	0.34	0.74	0.74	750.7	97	96	[illegible] 40 261	53	8.0	4.3
3	195/12:29	249	369	0.37	0.80	0.80	754.0	99	96	261	53	8.2	4.2
4	202.5/12:36	248	3	0.42	0.90	0.90	758.0	100	97	260	54	9.0	4.1
TOTAL													

AVERAGE

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#3   6B35450

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

CROSS SECTION

PLANT: Niles, Ohio [illegible]	AMBIENT TEMPERATURE: 82	METER ΔH@: 1.66
DATE: 7/23/93	BAROMETRIC PRESSURE: 29.16	C FACTOR: 0.90
LOCATION: outlet of baghouse	ASSUMED MOISTURE, %: 7	PROCESS WEIGHT RATE:
OPERATOR: Leonard Hugo	PROBE LENGTH, in.: 9 ft. glass	
STACK NO:	NOZZLE DIAMETER, in.: 0.249	
RUN NO.: N-19-MM5-723	STACK DIAMETER, in.: [illegible]	
SAMPLE BOX NO.: 3	PROBE HEATER SETTING: 250°F	
METER BOX NO.: X-4057.3	HEATER BOX SETTING: 250°F	

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H_2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % / VELOCITY
5	210/12:44	246	388	0.58	1.25	1.25	727.9	100	97	260	53	10.0	4.0
6	217.5/12:51.5	247	389	0.60	1.30	1.30	767.1	102	97	[illegible] 260	53	10.1	4.2
7	225/12:59	249	388	0.62	1.30	1.30	771.9	103	98	[illegible] 260	54	10.2	4.4
8	232.5/13:06.5	250	383	0.62	1.30	1.30	776.8	103	98	262	55	10.5	4.2
9	240/13:14	249	389	0.60	1.30	1.30	781.9	103	99	261	56	10.5	4.4
10	247.5/13:21.5	249	386	0.62	1.30	1.30	786.9	104	99	262	54	10.5	4.3
11	255/13:29	250	388	0.65	1.40	1.40	791.9	103	99	260	54	11.0	4.3
12	262.5/13:36.5	249	388	0.70	1.50	1.50	797.4	102	98	259	53	11.2	4.4
13	270/13:44	249	389	0.81	1.75	1.75	802.4	103	99	259	53	12.0	4.0
14	277.5/13:51.5	252	390	0.81	1.75	1.75	808.2	105	100	[illegible] 261	54	12.2	4.0
15	285/13:59	252	386	0.8	1.70	1.70	813.8	103	99	259	55	12.2	4.4
16	292.5/14:06.5	250	383	0.8	1.70	1.70	819.6	102	99	260	55	12.2	4.4
17	300.0/14:14	251	382	0.8	1.70	1.70	825.3	102	97	258	65	12.2	4.6
18	307.5/14:21.5	249	381	0.8	1.71	1.71	831.0	102	98	258	55	12.3	4.4
19	315.0/14:29	248	381	0.74	1.60	1.60	836.8	101	98	257	56	11.5	4.4
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

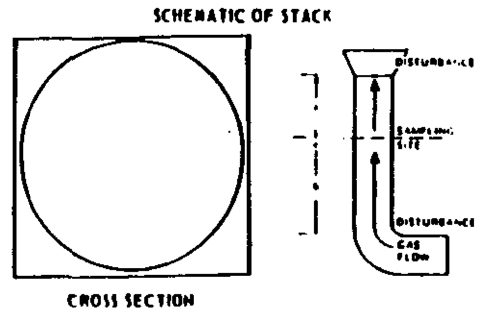
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SHOX process
DATE 7/23/92
LOCATION outlet of bag house
OPERATOR Leonard Happ
STACK NO. N-19-MMS-723
RUN NO. X
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 85°F
BAROMETRIC PRESSURE 29.16
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 3ft glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 240±
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE W...
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H_2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOC...
20	332.5/14:36.5	240	383	0.51	1.10	1.10	842.7	103	99	HB0-2 259	57	9.0	4.3
21	330/14:49	247	386	0.48	1.05	1.05	847.7	102	98	41 260	57	9.0	4.5
22	337.5/14:57.5	235	388	0.48	1.05	1.05	852.5	102	99	259	56	9.0	4.0
23	345/14:59		391	0.40	0.84	0.84	857.2	105	100	260	58	7.5	4.4
24	352.5/15:06.5		385	0.32	0.46	0.96	861.4	102	100	256	58	5.5	4.3
	360/15:14	off					864.497						
TOTAL													
AVERAGE													

leak check 0.032 at 15" Hg

COMMENTS

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

Page 1 of 4

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE	TEST DATE 7-23-93 (Fri)	ORIFICE CORRECTION 1.0572	HOT BOX NO. 8
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MMS-723	METER CORRECTION 1.0151	COLD BOX NO. 8
PROJECT NO. 93C028-01	NOZZLE (SIZE) I.D. .441"	CALIBRATION DATE 07-02-93	PROBE NO. 13-2
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 15.0" H_2O	PITOT CORRECTION 0.84	FILTER NO. unassigned
BAROMETRIC PRESSURE 29.38	PORT DIRECTION Port #2	CONTROL BOX NO. THREE	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	09:04	508.905	.03	.49	.49	81	81	1.0	628	~250°F	48°F	~250°F	15 ...
			.03	.49	.49	82	82	1.0	630			~300°F	
			.03	.41	.41	96	87	1.0	630				
90			.03	.41	.41	97	86	1.0	630				
			.04	.65	.65	100	86	2.0	631				
			.04	.65	.65	102	90	2.5	632				
70			.04	.65	.65	106	81	2.5	632				
			.04	.65	.65	107	94	2.5	635				
			.04	.65	.65	107	94	2.5	636				
50			.05	.81	.81	110	95	3.5	630				
			.05	.81	.81	113	97	4.0	635				
			.03	.49	.49	112	100	1.5	631				
30			.06	.97	.97	112	100	4.0	630				
			.06	.97	.97	112	102	4.0	631				
			.06	.97	.97	114	101	4.0	639				Estimates:
10			.06	.97	.97	116	102	4.0	636				MW=29.2
			.06	.97	.97	116	103	4.0	634				%H2O=9
	10:34	552.324	.06	.97	.97	115	103	4.0	630				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.02 cfm
After	13.0	<0.02 cfm

1st filter

PITOT LEAK CHECK

	Positive	Negative
Before	ok/15 sec	ok/15 sec
After	ok/15 sec	ok/15 sec

	1	2
CO2	14.0	14.0
O2	7.0	7.0
CO	0	0
N2	79.0	79.0

Fyrite check O_2 = 21% at 0935

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	XAD-2 + Condensate	1549.3	1226.3	323.0
2.	Empty	380.2	375.1	5.1
3.	100 ml DI H_2O	553.5	551.9	1.6
4.	100 ml DI H_2O	543.3	544.6	-1.3
5.	200 g Silica Gel	690.9	652.8	38.1

366.5 g total

Actual Moisture 8.3%

o	o		o	o	o	o
7	6		4	3	2	1

FLOW

AOE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-23-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	8
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-MMS-723	METER CORRECTION	1.0151	COLD BOX NO.	8
PROJECT NO.	73C628-01	NOZZLE (SIZE)	D= 0.241	CALIBRATION DATE	07-02-93	PROBE NO.	13-3
CONTROL BOX OPERATOR	RPC	STATIC PRESSURE	15.0" H_2O	PITOT CORRECTION	0.84	FILTER NO.	unweighed
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	Port #3	CONTROL BOX NO.	Thac C	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	10:40	552.324	-.10	1.62	1.62	115	103	6.0	646	250°F	<68°F	~300°F	15ma/ft
			.10	1.62	1.62	115	101	6.0	643				
			.10	1.62	1.62	115	101	6.5	644				
90"			.08	1.30	1.30	115	101	5.0	644				
			.10	1.62	1.62	114	100	6.5	655				
			.10	1.62	1.62	115	91	6.5	656				
70"			.10	1.62	1.62	115	100	6.5	655				
			.10	1.62	1.62	115	99	6.5	652				
			.10	1.62	1.62	116	99	6.5	653				
50"			.11	1.78	1.78	116	99	6.5	657				
			.11	1.78	1.78	116	100	6.5	651				
			.10	1.62	1.62	117	100	6.5	651				
30"			.04	.65	.65	114	100	3.0	654				
			.04	.65	.65	112	100	3.0	654				
			.04	.65	.65	112	100	3.0	655				Estimates:
10"			.04	.65	.65	115	100	3.0	653				MW= 29.2
			.03	.49	.49	111	100	2.5	657				%H2O= 9.0
	12:10	608.125	.03	.49	.49	111	100	2.5	639				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	4.0	<0.01 cfm

7.0 Filter

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT	Battelle / [illegible]	TEST DATE	07-23-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	8
TEST UNIT	SCR [illegible] outlet	TEST NO.	N-20-MAS- 723	METER CORRECTION	1.0151	COLD BOX NO.	8
PROJECT NO.	93C027-01	NOZZLE (SIZE,ft)	0.441	CALIBRATION DATE	07-22-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	LIC	STATIC PRESSURE	15.0" H_2O	PITOT CORRECTION	0.84	FILTER NO.	[illegible]
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	Port "H"	CONTROL BOX NO.	THREE	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
116"	12:16	668.125	.07	1.13	1.13	106	99	[illegible]	650	~250°F	<68°	~300°F	15 min/pt
			.08	1.30	1.30	109	100	[illegible]	668				
			.08	1.30	1.30	109	100	6.0	668				
90"			.09	1.46	1.46	115	100	6.5	675				
			.10	1.62	1.67	115	100	7.0	678				
			.10	1.62	1.62	116	100	7.0	679				
70"			.10	1.62	1.62	116	101	7.0	679				
			.10	1.62	1.62	116	101	7.5	682				
			.10	1.62	1.02	116	101	7.5	680				
50"			.11	1.77	1.77	117	102	7.5	682				
			.10	1.61	1.61	118	102	7.5	692				
			.10	1.61	1.61	118	102	7.5	682				
30"			.095	1.53	1.53	119	102	7.5	682				
			.11	1.77	1.77	119	103	8.0	688				
			.11	1.77	1.77	120	103	8.0	688				Estimates:
10"			.10	1.61	1.61	119	104	8.0	687				MW= 29.2
			.04	.64	.64	116	104	4.0	685				%H2O= 9.0
	13:46	668.045	.04	.61	.64	117	104	4.0	685				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.38

TEST DATE 07-23-93
TEST NO. N-20-MM5-723
NOZZLE (SIZE,#) 0.441"
STATIC PRESSURE 15.0" H2O
PORT DIRECTION Port #6

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. THREE

HOT BOX NO. 8
COLD BOX NO. 8
PROBE NO. 1.3-2
FILTER NO. unweighed
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	13:56	668.045	.06	.97	.97	104	104	5.0	689	~350°F	[illegible]	~300°F	15 min/pt
			.09	1.45	1.45	114	103	7.5	691				
14.11	14:11	675.448	.10	1.61	1.61	115	103	13.5	690				Change FLT
90"	14:28	675.540	.10	1.61	1.61	102	102	6.5	691				AT ~~[illegible]~~
	14:28'		.06	.97	.97	113	103	4.0	696				1411
			.06	.97	.97	115	102	4.0	698				
70"			.04	.64	.64	115	102	3.0	699				
			.04	.64	.64	115	103	3.0	700				
			.04	.64	.64	115	103	3.0	700				
50"			.05	.81	.81	116	103	4.0	702				
			.05	.81	.81	116	104	4.0	702				
			.06	.97	.97	117	103	4.0	700				
30"			.06	.97	.97	118	104	4.0	704				
			.06	.97	.97	119	104	4.0	702				
			.06	.97	.97	119	104	4.0	700				Estimates:
10'			.05	.81	.81	119	105	4.0	699				MW= 29.2
			.04	.64	.64	118	105	3.5	698				%H2O= 8.0
	15:43	714.108	.04	.64	.64	118	105	3.5	698				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

TOTAL TEST
TIME = 360 min
VOLUME = 205.111 dcf
$(\Delta P)_{AVG} = 0.065$

$(\Delta H)_{AVG} = 1.10$

$(T_{meter})_{AVG} = 106°F$
$(T_{stack})_{AVG} = 665°F$

velocity = 20.6 ft/s
ISO. = 93.2%

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TN
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-21-MM5-723
NOZZLE (SIZE,#) 0.195 #17
STATIC PRESSURE 0.7" H₂O
PORT DIRECTION A

ORIFICE CORRECTION ~~1.794~~ 1.802
METER CORRECTION ~~0.9652~~ 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 7

HOT BOX NO. 4
COLD BOX NO. 4-3A
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50" (depth) K9

Σ Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
0	46.4	0904	218.870	0.65	0.73	0.73	90	86	4.0	200	~250°F	<68°F	~250°F	13 min/point
				0.70	0.78	0.78	102	82	4.5	200				
13	39.3	17		0.65	0.73	0.73	104	82	4.5	200				Readings every
				0.70	0.80	0.80	106	83	5.0	200				6.5 min
26	32.1	30		0.85	0.98	0.98	116	90	6.0	200				
				0.85	0.98	0.98	118	90	6.0	200				
39	25.0	43		0.90	1.04	1.04	120	90	6.0	200				
				0.90	1.04	1.04	120	90	6.0	200				
52	17.9	56		0.75	1.10	1.10	120	94	6.0	200				
				0.95	1.10	1.10	120	94	6.0	200				
65	10.7	1009		0.90	~~1.04~~	1.04	121	94	6.0	200				
				0.90	1.04	1.04	121	94	6.0	200				
78	3.6	22		0.85	0.98	0.98	120	94	6.0	200	velocity = 58.0 ft/sec			
91		[illegible]	[illegible]	0.85	0.98	0.98	120	94	6.0	200				
		10:35	272.322									Bo = 100.62		Estimates:
														MW = 29.2
		Δ = 91 min	Δ = 53.452 dcf	(ΔP)avg = 0.85	(ΔH)avg = 0.95		(Tmeter)avg = 102°F			(Tstack)avg = 200°F				%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.010
After	6.0	0.010

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	MP-2 + Condensate	1561.4	1266.1	295.3
DRY 2.	~~100 ml DI H2O~~	497.6	424.7	72.9
100 ml H2O	~~100 ml DI H2O~~	544.5	542.1	2.4
100 ml H2O	~~Empty~~	475.4	505.9	-30.5
3.	200 g Silica Gel	714.2	671.0	43.2

Actual Moisture 7.8%

383.3 g tot

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

Page 2 of 4

CLIENT Battelle / DOE
TEST UNIT Stack Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TM
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-21-MM5-723
NOZZLE (SIZE,#) 0.195 617
STATIC PRESSURE 0.7" H₂O
PORT DIRECTION B

ORIFICE CORRECTION ~~1.754~~ 1.802
METER CORRECTION ~~0.9890~~ 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. #7

HOT BOX NO. 4
COLD BOX NO. 4434
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50" (depth) x 9 (width)

ΣTime	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
0	46.4	10:43	272.538	0.80	0.93	0.93	102	92	7.0	200	~250°F	<68°F	~250°F	13 min/point
		:9		1.00	1.16	1.16	112	92	8.0	200				
13	39.3	:5		1.40	1.62	1.62	118	92	9.5	202				Readings every
				1.40	1.62	1.62	118	92	9.5	202				6.5 min
26	32.1	" "		1.40	1.62	1.62	119	92	10.0	201				
				1.40	1.62	1.62	120	92	10.0	201				
39	25.0	:29		1.35	1.56	1.56	120	92	10.5	202				
				1.30	[illegible]	[illegible]	120	92	11.0	201				
52	17.9	37		1.30	1.50	1.50	115	92	10.5	201				
				1.00	1.15	1.15	118	92	7.5	201				
65	10.7	30		1.10	1.27	1.27	119	92	9.0	200				
				1.10	1.27	1.27	120	92	9.0	204				
78	3.6	12:03		1.00	1.15	1.15	120	92	8.0	203				
				1.00	1.15	1.15	120	92	8.0	204				
91		12:16	337.480											Estimates:
														MW= 29.2
		Δ=91 min	Δ=64.958 dcf	$(\Delta p)_{avg}$ = 1.15	$(\Delta H)_{avg}$ = 1.40		$(T_{meter})_{avg}$ = 105°F			$(T_{stack})_{avg}$ = 202°F				%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	14.0	0.010

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

velocity = 67.6 ft/sec
Iso. = 104.8%

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TH-4385
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-21-MM5-723
NOZZLE (SIZE,#) 0.195 917
STATIC PRESSURE 0.7" H_2O
PORT DIRECTION C

ORIFICE CORRECTION ~~1.734~~ 1.202
METER CORRECTION ~~0.999~~ 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. #7

HOT BOX NO. 4
COLD BOX NO. 4/73A
PROBE NO. 10-3
FILTER NO.
STACK DIA. 50' (depth) x

ΣTime	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (with)
0	46.4	1229	338.263	0.75	0.87	0.87	106	94	6.0	198	~250°F	<68°F	~250°F	13 min/point
				0.85	0.98	0.98	114	94	6.5	199				
13	39.3	1242		1.20	1.39	1.39	120	93	8.0	202				Readings every 6.5 min
				1.25	1.45	1.39	122	95	10.0	201				
26	32.1	1255		1.35	1.57	1.57	124	95	12.0	201				
				1.35	1.57	1.57	122	96	12.0	200				
39	25.0	1308		1.50	1.74	1.74	122	97	14.0	201				
				1.50	1.74	1.74	120	97	14.0	198				
52	17.9	1321		1.40	1.67	1.67	120	98	14.0	197				
				1.40	1.75	1.75	120	98	15.0	197				
65	10.7	1334		1.40	1.75	1.75	118	98	16.5	197				
				1.40	1.76	1.75	118	98	17.0	196				
78	3.6	1347		1.15	1.34	1.34	116	98	15.0	194				
91		1400	403.045	1.15	1.34	1.34	118	98	15.0	194				Estimates:
		Δ 91 min	Δ = 64.782 dcf	(ΔP)avg = 1.25	(ΔH)avg = 1.49		(Tmeter)avg = 107°F			(Tstack)avg = 198°F				MW = 29.2 %H2O = 8.5

velocity = 10.3 ft/sec. Iso. = 99.5%

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	17.0	0.020

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO_2	14.0	
O_2	5.0	
CO	0	
N_2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR JPS
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-21-MM5-723
NOZZLE (SIZE,#) 0.195 G17
STATIC PRESSURE 0.7" H2O
PORT DIRECTION D

ORIFICE CORRECTION ~~1.734~~ 1.802
METER CORRECTION ~~0.9853~~ 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 7

HOT BOX NO. 4
COLD BOX NO. 4+34
PROBE NO. 10-3
FILTER NO.
STACK DIA 58" (depth) x 9

ΣTime	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
0	46.4	1407	403.485	0.95	1.11	1.11	116	98	13.0	197	~250°F	<68°F	~250°F	13 min/point
				0.95	1.11	1.11	118	98	14.5	198				
13	39.3	1420		0.80	0.94	0.94	118	98	14.5	196				Readings every
				0.85	1.00	1.00	118	98	15.0	197				6.5 min
26	32.1	1433		1.15	1.35	1.35	118	98	20.0	199				
				1.10	1.29	1.29	108	96	20.0	195				
39	25.0	1446		0.90	1.05	1.05	108	97	20.0	196				
				0.90	1.05	1.05	108	97	20.0	195				
52	17.9	1459		1.00	1.17	1.17	108	97	20.0	196				
				1.00	1.17	1.17	108	97	20.0	196				
65	10.7	1512		1.00	1.17	1.17	108	97	20.0	192				
				1.06	1.17	1.17	108	97	20.0	193				
78	3.6	1525		0.90	1.05	1.05	108	97	20.0	190				
91		1538	461.342	0.85	0.99	0.99	108	97	20.0	196				
														Estimates:
		Δ=91 min	Δ=57.857 dcf	$(\sqrt{\Delta P})_{avg}$ = 0.95	$(\Delta H)_{avg}$	=1.12	$(T_{meter})_{avg}$	= 104°F		$(T_{stack})_{avg}$ = 195°F				MW=29.2
										velocity = 61.1 ft/sec				%H2O=8.5

I.50. = 102.3%

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	20.0	0.020

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	Bal	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

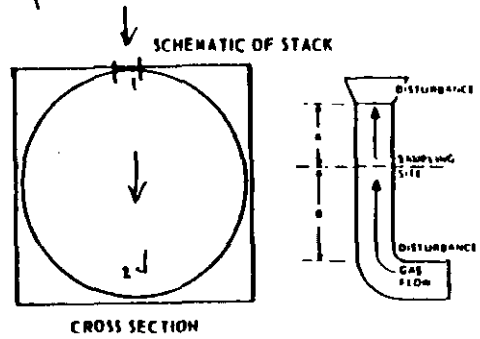
KEYSTONE

AQE 2/92

D-2: Multi-Metals (Method 29)

PARTICULATE ' ELD DATA

N-18-MUM-719



PLANT Niles
DATE 7-19
LOCATION OH IN 18
OPERATOR Well / Cof
STACK NO.
RUN NO. 2 Metals
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 28.95
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. .215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA[SH]
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER (Tol)	SAMPLING TIME (θ), min	STATIC PRESSURE (in H₂O) (Time)	STACK TEMPERATURE (T_s), °F (4)	VELOCITY HEAD (ΔP_s)	% O₂	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Flt #8	Probe #2	#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	#3 Box
								90.466							
1	0	10:42		~~.3~~	~~.3~~	~~.42~~	~~.42~~								
2					3.9			96.4	79	96	251	254	57	3	
3	24		391	.37	~~.32~~	.47	.47								
4	32		410	.4		.52	.52	102.8							
5	40		419	.55	4.0	.72	.72	Lost power for ~ 1 minute !! Heat [illegible]							
6	48			-				115.5							
7	56	11:38	411	.72	4.8	.92	.92	~~115.5~~	Adj nomograph					4 1/2	
8	4		416	.75		1.1	1.1	121.0	100	96	250	255	52		248
9	12		412	.8	4.4	1.15	1.15	123.8						6	
10	20		412	.9		1.28	1.28	129.2	106	99					
11	28		412	.95	4.3	1.35	1.35	135.0			252	257	63	8	249
12	36		405	1.0		1.4	1.4	140.6	108	99					
								145.4							
TOTAL															
AVERAGE															

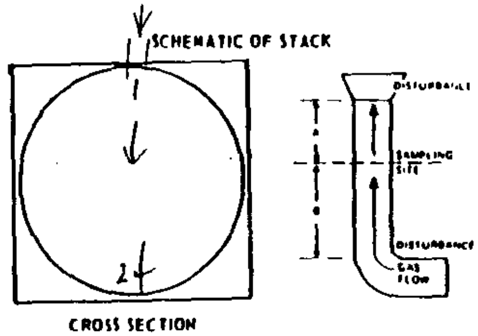
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS
• Pre leak check 0.15 at 20" Hg
• Pts 1, 2 = zero flow start pt 3

2

PARTICULATE ELD DATA



PLANT Niley
DATE 7-19
LOCATION 18 BH N
OPERATOR Walk / Cot
STACK NO
RUN NO. 2 Metals
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 28.95
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR .90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time — STATIC PRESSURE (~~in~~ H_2O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	/ % O_2 (~~$\sqrt{\Delta P_s}$~~)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Box #8	Probe #2	#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Box #3 ~~VELOCITY fps~~
13	44	12:26	390	1.0	4.3	1.4	1.4	145.4	108	100	257	258	65	9½	248
14	52		392	1.0		1.4	1.4	~~157.5~~							
15	60		394	.96	4.0	1.38	1.38	157.3	109	102	251	258	63	12	248
16	8	12:50	397	.88		1.22	1.22	164.6							
17	16		400	.85	4.1	1.2	1.2							12	
18	24	13:06	400	.85		1.2	1.2	176.0	111	105	252	260	71		248
19	32		400	.82	4.3	1.15	1.15	181.0							
20	40		404	.78		1.1	1.1								
21	48	13:22	402	.75		1.08	1.08	192.0	115	108	252	261	67	14	249
22	56		403	.72	[illegible]	.98	.98	197.1							
23	4		401	.55		.78	.78							13	
24	12			.50		.69	.69								
		13:55						~~Stop~~ 210.66							
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

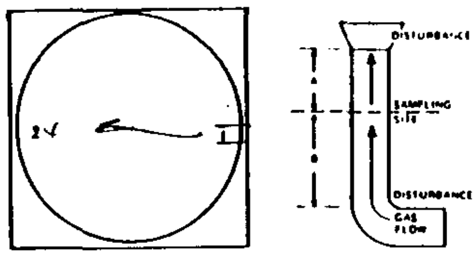
COMMENTS

3

PARTICULATE 'ELD DATA

Ref Δp = 1.3

SCHEMATIC OF STACK



CROSS SECTION

PLANT Tilan
DATE 7-19-93
LOCATION #18
OPERATOR Webb / coy
STACK NO.
RUN NO. 2 MM
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 28.93
ASSUMED MOISTURE, % 6
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. .215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250 F
HEATER BOX SETTING 250 F

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in. H_2O)~~	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Flex	Probe	#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Box #3 ~~VELOCITY~~
	0	16:56						210.66			#8	#2			
1															
2	16	17:12	340	.3		.90	.40		101	100	255	250			
3	24		355	.5	4.4	.70	.70	215.5					79	10	249
4	32		358	.70		.98	.98								
5	40		364	.78		1.1	1.1							15	
6	48	17:44	361	0.83	4.1	1.15	1.15	227.3	112	107	252	251	64		248
7	56		363	0.85		1.2	1.2	232						19	
~~8~~	~~4~~	~~17:5~~	17:49					237.2 stop	filter broken		Replace filter - drain condensate #1 impinger ~250 mL				
7	4	18:07				Start									
8	12		365	.9	3.5	1.25	1.25	241.0							
9	20		366	1.0		1.4	1.4	248.	113	105	252	253	63		249
10	28		367	1.0		1.4	1.4								
11	36		369	1.0		1.4	1.4	258.6	114	107					
12	44		380	1.1		1.5	1.5							8	
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

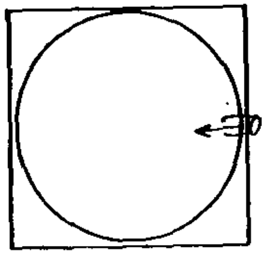
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS no flow on pt #1

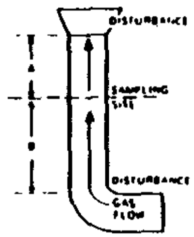
4

PARTICULATE ' ELD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT Niles

DATE 7-19-93

LOCATION BH IN / 18

OPERATOR Webb / Cox

STACK NO.

RUN NO. 2 metals

SAMPLE BOX NO.

METER BOX NO. X-40513

AMBIENT TEMPERATURE 90

BAROMETRIC PRESSURE 28.95

ASSUMED MOISTURE, % 6

PROBE LENGTH, in. 96

NOZZLE DIAMETER, in. 0.215

STACK DIAMETER, in. 80

PROBE HEATER SETTING 250

HEATER BOX SETTING 250

METER ΔH@ 1.64

C FACTOR 0.9

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in. H_2O)~~	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F #8	#2	#9 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Box #3 ~~VELOCITY~~
13	52			1.1	3.9	1.5	1.5							8	
14	60	19:06	403	1.0		1.4	1.4	277.5	115	107			74		
15	8		405	.98	4.0	1.35	1.35								
16	16	19:24	408	0.90		1.22	1.22	289.7	113	106	252	257	80	9	249
17	24		412	.88	4.1	1.2	1.2	295.1							
18	32		412	.85		1.2	1.2	301.1	111	107				9½	
19	40		418	.82	9.0	1.12	1.12	308.9							
20	48		416	.79		1.1	1.1	312.7						10½	248
21	56	20.05	421	.75		1.05	1.05	323.1	112	106	252	260	67		
22	4		423	0.70		.98	.98	327.9							
23	12								?						
24	20	20:30	423	.6		.82	.82	332.1	110	105	254	261	70	10	248
								335.952	Stop						
								90.466							
TOTAL								245.486							
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Post leak check = .022 at 15 with flex - w/o s/s probe
with s/s probe at 4" = .01

NOMOGRAPH DATA

PLANT Niles, Ohio, SNOx process

DATE July 19, 1993

SAMPLING LOCATION outlet of bag house

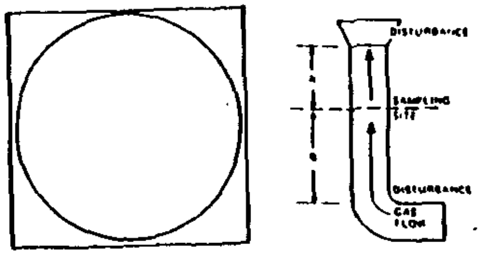
N-19-MUM-718

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	2895
STATIC PRESSURE IN STACK, in. Hg (P_m ± 0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	28.918 27" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	0.999 .93
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	380
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.642
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	1.05
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp, in. H_2O		0.82

EPA (Dur) 234
4/72

PARTICULATE F[illegible]LD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio [illegible]
DATE 7/19/93
LOCATION outlet of baghouse
OPERATOR Leonard Hupp
STACK NO. ______
RUN NO. N-19-MUM-719
SAMPLE BOX NO. 3
METER BOX NO. X-40513

AMBIENT TEMPERATURE 75°F
BAROMETRIC PRESSURE 28.95
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft.
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe Temp °F (STATIC PRESSURE (in. H₂O))	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 %
1	0 / 9:58	250	285	0.43	0.94	0.94	681.987	80	80	256	54	6.0	4.6
2	10 / 10:08	251	340	0.48	1.10	1.10	687.4	81	79	258	53	5.1	5.0
3	20 / 10:18	252	316	0.51	1.13	1.13	693.5	86	81	257	54	5.1	6.0
4	30 / 10:28	254	385	0.64	1.4	1.4	~~[illegible]~~	87	83	258	55	5.1	5.0
5	40 / 10:38	254	384	0.64	1.4	1.4	705.2	89	85	257	55	5.1	5.0
6	50 / 10:48	256	384	0.62	1.39	1.39	711.8	91	86	257	55	6.0	4.0
7	60 / 10:58	256	385	0.6	1.38	1.38	718.2	91	86	256	56	6.0	4.5
8	70 / 11:08	257	384	0.65	1.40	1.40	724.9	92	87	257	58	6.0	4.5
9	80 / 11:18	257	384	0.60	1.40	1.40	731.9	92	88	257	59	6.0	4.5
10	90 / 11:28	255	384	0.58	1.30	1.30	738.8	91	87	256	60	6.0	4.5
11	100 / 11:38	255	383	0.64	1.40	1.40	745.7	91	88	257	61	6.0	4.5
12	110 / 11:48	256	384	0.59	1.30	1.30	752.5	91	87	256	63	6.0	4.5
13	120 / 11:58	257	385	0.59	1.30	1.30	759.3	94	89	259	65	6.0	4.6
14	130 / 12:08	368	385	0.6	1.31	1.31	765.9	95	90	260	77	6.0	4.5
15	140 / 12:18	378	385	0.98	2.20	2.20	772.6	94	90	259	70	6.0	4.5
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

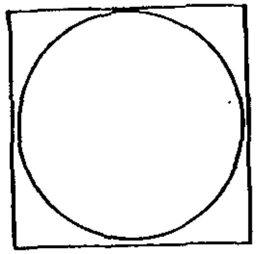
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

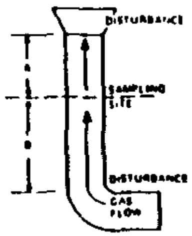
v

PARTICULATE F̶ELD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT Niles Ohio SNOX [illegible]
DATE 7/19/93
LOCATION [illegible] of bag house
OPERATOR Leonard, [illegible]
STACK NO. ______
RUN NO. N-19-MUM-719
SAMPLE BOX NO. 3
METER BOX NO. X 40513

AMBIENT TEMPERATURE 80°F
BAROMETRIC PRESSURE 28.95
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft.
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8ft
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	probe Temp °F ~~STATIC PRESSURE (in. H_2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % ~~VELOCITY fpm~~
16	150/12:28	379	384	1.0		2.2	2.2	750.9	93	89	255	72	8.0	4.5
17	160/12:38	381 ~~384~~	384	1.2		2.15	2.15	787.3	93	90	256	77	8.0	4.5
18	170/12:48	381	384	0.64		1.45	1.45	797.8	94	90	257	81	6.5	4.5
19	180/12:58	380	384	0.52		1.20	1.20	804.9	93	90	257	77	6.0	4.4
20	190/13:08	382	384	0.45		1.00	1.00	811.5	95	91	259	77	5.5	4.5
21	200/13:18	382	384	0.5		1.1	1.1	817.4	96	92	259	79	5.5	4.5
22	210/13:28	381	384	0.45		1.0	1.0	823.3	96	93	259	82	5.5	4.5
23	220/13:38	381	383	0.43		0.98	0.98	829.1	97	93	258	84	5.5	4.6
24	230/13:48		384	~~0.62~~ [illegible]		1.4	1.4	835.9						
End	93.58			0.34		0.75	0.75	840.93						
SIDE														
1	240/14:40	250	320	0.25		0.55	0.55	840.93	87	86	258	70	4.8	4.6
2	250/14:50	250	348	0.20		0.46	0.46	844.8	87	86	256	62	4.4	4.4
3	260/15:00	253	357	0.38		0.85	0.85	848.8	90	87	258	63	5.0	4.4
4	270/15:10	254	375	0.45		1.0	1.0	852.9	92	88	258	60	5.5	4.3
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

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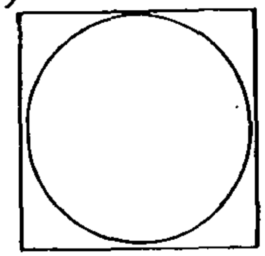
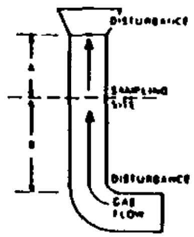
7

PARTICULATE F ⁻LD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT nike, Ohio snox process
DATE 7/19/93
LOCATION outlet of baghouse
OPERATOR Leonard, Hupp
STACK NO.
RUN NO. N-19-MUM-719
SAMPLE BOX NO. 3
METER BOX NO. X40513

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 9 ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.60
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	probe temp °F ~~STATIC PRESSURE ($in. H_2O$)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY fps
5	290/15:20	255	~~253~~ 383	0.53	1.20	1.20	859.9	95	90	258	62	6.8	44
6	290/15:30	257	384	0.61	1.35	1.35	865.8	97	92	258	64	6.2	4.2
7	300/15:40	259	385	0.63	1.40	1.40	872.8	100	94	259	64	6.3	4.3
8	310/15:50	260	385	0.59	1.30	1.30		101	97	258	65	6.0	4.0
9	320/16:00	259	385	0.68	1.50	1.50	886.4	103	99	258	68	6.0	4.4
10	330/16:10	262	388	0.68	1.50	1.50	892.0	107	102	260	69	6.0	4.4
11	340/16:20	256	386	0.75	1.80	1.80	899.5	105	101	257	70	7.0	4.7
12	350/16:30	256	382	0.77	1.80	1.80	906.8	105	102	257	70	7.0	4.6
13	360/16:40	268	381	0.87	1.95	1.95	914.6	107	102	258	75	7.0	4.5
14	370/16:50	362	382	0.86	1.90	1.90	922.3	110	106	259	76	7.0	4.7
15	380/17:00	372	380	0.79	1.80	1.80	930.7	109	105	259	76	7.0	4.8
16	390/17:10	377	382	0.79	1.80	1.80	938.6	110	105	258	79	7.0	5.0
17	400/17:20	379	382	0.79	1.80	1.80	946.4	110	106	259	83	7.0	5.0
18	410/17:30	379	382	0.79	1.80	1.80	954.3	111	107	260	86	7.0	4.8
19	420/17:40	379	382	0.97	1.95	1.95	962.1	111	107	260	89	7.5	4.9
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

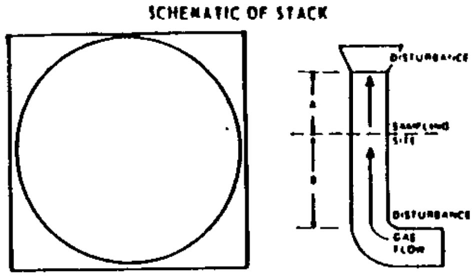
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

4

PARTICULATE F ːLD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio Shorrocks

DATE 7/19/93

LOCATION outlet of bag house

OPERATOR Leonard, Kupp

STACK NO. ______

RUN NO. N-19-MUM-719

SAMPLE BOX NO. 3

METER BOX NO. X-40513

AMBIENT TEMPERATURE 85°

BAROMETRIC PRESSURE 29.15

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 9 ft. glass

NOZZLE DIAMETER, in. 0.247

STACK DIAMETER, in. 8 ft.

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER ΔH@ 1.60

C FACTOR 0.90

PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	probe temp °F STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_S), °F	VELOCITY HEAD (ΔP_S) ($\sqrt{\Delta P_S}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY fpm
20	430/17:50	378	381	0.80	1.80	1.80	970.4	113	108	259	74	7.0	6.2
21	440/18:00	378	382	0.61	1.40	1.40	978.3	113	108	260	64	6.0	5.0
22	450/18:10	378	381	0.63	1.40	1.40	985.5	114	110	259	60	6.3	5.2
23	460/18:20	377	381	0.58	1.30	1.30	992.6	114	110	259	60	6.0	5.0
24	470/18:30	379	381	0.62	1.40	1.40	999.7	114	110	259	63	6.0	5.1
	480/18:40	off					1007.381						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS: leak rate 0.009 at 10" Hg.

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 2-19-93 (Mon)	ORIFICE CORRECTION 1.572	HOT BOX NO. 6
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MUM-719	METER CORRECTION 1.0151	COLD BOX NO. 6
PROJECT NO. 93X028-01	NOZZLE (SIZE,#) 0.441 6-34	CALIBRATION DATE 07-02-93	PROBE NO. 13-1
CONTROL BOX OPERATOR RK	STATIC PRESSURE +17.0" H_2O	PITOT CORRECTION 0.84	FILTER NO. —
BAROMETRIC PRESSURE 29.10	PORT DIRECTION Port 4	CONTROL BOX NO. THREE	STACK DIA. 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110	10:08	150.730	.10	1.59	1.59	86	93	1.0	680	~250°F	68°F	250°F	[illegible]
90			.10	1.59	1.58	89	85	1.0	669				
70			.10	1.59	1.59	102	88	1.5	670				
~~50~~			.11	1.75	1.75	105	90	3.0	672				
~~30~~			.10	1.59	1.59	106	90	3.0	678				
~~10~~			.10	1.59	1.57	108	92	3.0	677				
			.10	1.59	1.59	109	93	3.5	679				
			.10	1.59	1.59	109	93	3.5	679				
70			.11	1.75	1.75	111	95	4.5	680				Stopped test at
	10:58	782.850	.11	1.75	1.75	111	95	8.5	681				0158 to change
	11:46	782.850	.10	1.59	1.59	96	92	1.0	684				filter.
	11:56	789.358	.10	1.59	1.59	104	92	1.0	683	Stopped at	11:56 [illegible]		Restarted at
60	12:51	789.358	.10	1.59	1.57	91	90	2.0	683	of backflush reset			1146 ([illegible])
			.10	1.59	1.59	103	91	3.5	688	[illegible]	[illegible] (initial)		
			.10	1.59	1.59	104	91	3.5	689		at 1251		Estimates:
			.10	1.59	1.59	105	92	3.5	689				MW= 29.2
30			.090	1.43	1.43	110	97	4.0	687				%H2O= 9
			.09	1.43	1.43	112	97	4.5	688				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.02 cfm
After	5.0	<0.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before	0"/15sec	0"/15sec
After	0"/15sec	0"/15sec

	1	2
CO2	13.0	13.0
O2	6.0	6.0
CO	0	0
N2	81.0	81.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	150 ml HNO_3/H_2O_2	924.4	606.9	317.5
2.	150 ml HNO_3/H_2O_2	704.0	630.5	73.5
3.	Empty	487.2	462.0	25.2
4.	100 ml $KMnO_4$	550.0	499.7	50.3
5.	100 ml $KMnO_4$	478.3	559.4	-81.1
6.	200 g Silica Gel	672.2	637.?	35.0

Actual Moisture 10.1%

420.4 total

FLOW ↓

o	o	o	o	o	o	o
7	6	5	4	3	2	1

AQE 2/92

KEYSTONE

10

STACK SAMPLING DATA SHEET

CLIENT BATTELLE - DOE - NILES | TEST DATE 07-19-93 | ORIFICE CORRECTION 1.572 | HOT BOX NO. 6
TEST UNIT SCR REACTOR OUTLET | TEST NO. N-20-MUM-719 | METER CORRECTION 1.0151 | COLD BOX NO. 6
PROJECT NO. 93Cd 28-01 | NOZZLE (SIZE,#) 0.441 G-37 | CALIBRATION DATE 07-02-93 | PROBE NO. 13-1
CONTROL BOX OPERATOR C/C | STATIC PRESSURE +17.0" H2O | PITOT CORRECTION 0.84 | FILTER NO.
BAROMETRIC PRESSURE 29.10 | PORT DIRECTION Port 4, Port 3 | CONTROL BOX NO. THREE | STACK DIA. 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.09	1.43	1.43	114	100	5.5	680	~280	46°F	~300°F	
			.09	1.43	1.43	114	100	5.5	690				
10.0			.03	.48	.48	114	101	3.0	649				
			.03	.48	.48	115	100	3.0	651				
			.03	.48	.48	115	103	6.5	680				
	13:51	824.488	.03	.48	.48	115	103	8.5	688		Changed filter		
											between ports		
11.0"	14:19	824.881	.04	.64	.64	100	100	1.0	680		new frame		
			.04	.64	.64	112	100	1.0	646				
			.04	.64	.64	113	100	1.0	640				
			.04	.64	.64	113	100	1.0	648				
9.0			.04	.64	.64	113	101	1.5	650				
			.04	.64	.64	113	101	1.5	654				
			.04	.64	.64	112	101	2.0	657				
			.04	.64	.64	113	101	2.5	656				Estimates:
7.0			.04	.64	.64	112	102	3.5	655				MW= 29.3
			.04	.64	.64	112	102	5.5	661				%H2O= 9
			.04	.64	.64	112	102	5.5	684				

Port 3

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	20.015 cfm
After	8.0	<0.02 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle - AOS - Niles	TEST DATE 07-19-93	ORIFICE CORRECTION 1.572	HOT BOX NO. 6
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MUM-7A	METER CORRECTION 1.0151	COLD BOX NO. 6
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.441 G-37	CALIBRATION DATE 07-02-93	PROBE NO. 13-1
CONTROL BOX OPERATOR RPC	STATIC PRESSURE +1.20" H2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.70	PORT DIRECTION Port 3 Port 2	CONTROL BOX NO. Frame	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	15:19	852.454	.04	.64	.64	112	102	12.5	680	~250	<68°F		Change [illegible] at 15:19
50'	15:48	852.600	.04	.65	.65	107	101	1.0	655				
			.04	.65	.65	109	101	1.0	655				
			.04	.65	.65	112	100	1.0	655				
			.05	.81	.81	114	101	1.5	655				
30'			.04	.65	.65	115	102	1.5	654				
			.04	.65	.65	116	103	1.5	655				
			.04	.65	.65	116	103	1.5	651				
			.04	.65	.65	116	104	1.5	651				
10"			.04	.65	.65	116	104	2.0	656				
			.04	.65	.65	117	105	3.5	640				
			.04	.65	.65	119	105	6.0	651				
	16:48	881.496	.04	.65	.66	120	105	12.5	656		Change filters		
											between ports		Estimates:
110	18:40	982.475	.04	.65	.66	98	95	1.0	635				MW= 29.2
			.04	.65	.65	106	96	1.5	635				%H2O= 9.0
			.04	.65	.65	110	96	1.5	650				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.02cfm
After	13.0	<0.01cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle DOE N1265 | TEST DATE 07-19-93 | ORIFICE CORRECTION 1.572 | HOT BOX NO. 6
TEST UNIT SCR Reactor Outlet | TEST NO. N-20-MUM-719 | METER CORRECTION 1.0151 | COLD BOX NO. 6
PROJECT NO. 93C028-01 | NOZZLE (SIZE,#) ~~0.444~~ G-37 | CALIBRATION DATE 07-02-93 | PROBE NO. 13-1
CONTROL BOX OPERATOR RC | STATIC PRESSURE 0.441 17.0" H2O | PITOT CORRECTION 0.84 | FILTER NO.
BAROMETRIC PRESSURE 29.80 | PORT DIRECTION Port 2 | CONTROL BOX NO. Three | STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.04	.65	.65	111	99	1.5	656	~250	<68	~300°	20 ml/pt
90			.04	.65	.69	111	99	1.5	634				
			.04	.65	.65	111	99	1.5	635				
			.04	.65	.65	112	99	1.5	630				
			.04	.65	.65	114	100	1.5	635				
70			.04	.65	.68	115	101	1.5	632				
			.04	.65	.65	114	102	1.5	626				
			.04	.65	.65	115	102	2.0	629				
			.04	.65	.65	116	102	2.0	625				
50			.05	.81	.81	117	103	2.0	639				
			.05	.81	.81	117	102	2.0	639				
			.04	.65	.65	117	102	2.0	636				
			.04	.65	.65	115	103	2.0	637				
30			.04	.65	.65	116	103	2.0	636				
			.04	.65	.65	116	104	2.0	632				Estimates:
			.04	.65	.65	116	103	2.0	637				MW= 29.2
			.04	.65	.65	115	103	2.0	632				%H2O= 9.0
10			.04	.65	.65	115	102	2.0	640				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.02 cfm
After	5.0	<0.015 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle-Dor-Niles
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR R/C
BAROMETRIC PRESSURE 29.70

TEST DATE 07-8-93
TEST NO. N-20-Aum-7.1
NOZZLE (SIZE,#) 0.244 G-37
STATIC PRESSURE 0.441 12.0 "H2O
PORT DIRECTION Port #2

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. THREE

HOT BOX NO. 6
COLD BOX NO. 6
PROBE NO. 3-1
FILTER NO.
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.04	.65	.65	116	103	2.0	629	~250	68°F Room	~300°F	20 nm/01
			.04	.65	.65	116	103	2.0	630				
	20:40	942.845	.04	.65	.65	116	103	2.0	631				
	Δ=6hr	Δ=190.597	$(\Delta P)_{AVG}$ =	$(\Delta H)_{AVG}$ =		$(T_{meter})_{AVG}$ = 105°F			$(T_{stack})_{AVG}$ = 655°F				
	=360	dcf			0.90								
	min		0.055										
									Velocity = 18.9 ft/sec				
									Iso = 93.2%				
													Estimates:
													MW= 29.2
													%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 1.734	HOT/COLD BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-719	METER CORRECTION (Y) 0.9832	PROBE NO. 10-4
PROJECT NO. 93C628-01	NOZZLE (SIZE,#) 0.197 #G18	CALIBRATION DATE 5-17-93	FILTER NO. #3
TEST CREW JB, TM	STATIC PRESSURE 0.8" H2O	PITOT CORRECTION 0.84	STACK DIA. 50" (depth) X
BAROMETRIC PRESSURE 29.10	PORT DIRECTION A	CONTROL BOX NO. 5	PORT SIZE 99" (width)

Time	Traverse Point (inches)	Time 1003	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
0	46.4	[illegible]	[illegible]	0.8	0.89	0.89	88	82	2.0	198	~250°F	68°F	~250°F	18 min./point
			070.962	0.8	0.89	0.89	102	90	2.0	198				
18	39.3	1021		0.8	0.91	0.91	107	95	2.0	199				Readings every
				0.8	0.93	0.93	110	97	2.0	199				9 min
36	32.1	1039		0.9	1.05	1.05	112	100	2.0	199				
				0.9	1.06	1.05	113	101	2.0	199				
54	25.0	1057		1.1	1.28	1.28	115	102	2.0	198				
				1.1	1.28	1.28	115	104	2.0	199				
72	17.9	1115		1.1	1.28	1.28	116	103	3.0	199				
				1.1	1.28	1.28	116	105	3.0	199				
90	10.7	1133		1.2	1.40	1.40	117	104	3.0	198				
				1.2	1.40	1.40	117	104	3.5	196				
108	3.6	1151		1.2	1.40	1.40	116	104	3.5	196				
126		1209	150.927	1.2	1.40	1.40	116	105	3.5	195				
														Estimates:
														MW=29.2
														%H2O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	6.0	0.020
After	4.0	0.005

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After	OK	OK

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	150mL HNO3/H2O2	681.8	535.9	145.9
2.	150mL HNO3/H2O2	691.2	559.0	132.2
3.	Empty	744.9	466.1	278.8
4.	100mL KMnO4	563.9	557.6	6.3
5.	100mL KMnO4	543.6	547.8	-4.2
6.	200g Silica Gel	712.7	663.4	49.3

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608.3g total

Time = 126 min
Volume = 79.965 dcf
$(\Delta P)_{avg} = 1.0$
$(\Delta H)_{avg} =$ [illegible] 1.17

$(T_{meter})_{avg} = 106°F$

velocity = 63.1 ft/sec

Actual

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C628-01
TEST CREW JDS, TM
BAROMETRIC PRESSURE 29.10

TEST DATE 7-19-93 (Mon.)
TEST NO. N-21- MUM - 79
NOZZLE (SIZE,#) 0.197 #618
STATIC PRESSURE 0.8" H₂O
PORT DIRECTION B

ORIFICE CORRECTION (ΔH@) 1.734
METER CORRECTION (Y) 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT/COLD BOX NO. 5
PROBE NO. 10-4
FILTER NO. #3
STACK DIA. 50' (depth) X
PORT SIZE 99' (width)

E.Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
0	46.4	1222	151.113	0.8	0.93	0.93	107	103	2.5	196	~250°F	<68°F	~250°F	18 min./point
				0.8	0.93	0.93	112	103	2.5	195				
18	39.3	1240		1.1	1.28	1.28	115	103	3.5	196				Readings every
				1.1	1.30	1.30	115	104	3.5	196				9 min
36	32.1	1258		1.1	1.30	1.30	117	104	3.5	196				
				1.1	1.29	1.29	117	106	4.0	196				
54	25.0	1316		1.0	1.17	1.17	118	106	4.0	197				
				1.0	1.17	1.17	118	107	3.5	198				
72	17.9	1334		1.0	1.17	1.17	120	107	3.5	198				
				1.0	1.17	1.17	119	108	3.5	198				
90	10.7	1352		0.6	0.70	0.70	118	108	3.0	198				
				0.6	0.70	0.70	116	107	3.0	197				
108	3.6	1410		0.5	0.59	0.59	116	107	2.5	197				
126		1428	225.920	0.5	0.59	0.59	116	107	2.5	197				
														Estimates:
														MW= 29.2
														%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	4.0	0.005

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Bag 12 skt
TIME = 126 min
VOLUME = 74.807 dcf
$(\Delta P)_{AVG}$ = 0.9
(All. × 1.0?

$(T_{meter})_{AVG}$ = 111°F

Velocity = 59.8 ft/sec
%I. = 96.8%

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 1.734	HOT/COLD BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-719	METER CORRECTION (Y) 0.9832	PROBE NO. 10-4
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.197 #8B	CALIBRATION DATE 5-17-93	FILTER NO. #3
TEST CREW JB, TM	STATIC PRESSURE 0.8" H_2O	PITOT CORRECTION 0.84	STACK DIA. 50" (depth) x
BAROMETRIC PRESSURE 29.10	PORT DIRECTION C	CONTROL BOX NO. 5	PORT SIZE 99" (width)

5 Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
0	46.4	1438	226.011	1.0	1.17	1.17	110	107	4.0	196	~250°F	<68°F	~250°F	18 min./point
	[illegible]			1.0	1.17	1.17	115	105	5.0	196				
18	39.3	1456		1.1	1.29	1.29	116	104	5.5	196				Readings every
				1.1	1.29	1.29	116	105	5.5	197				9 min.
36	32.1	1514		1.3	1.53	1.53	118	106	7.0	198				
				1.3	1.53	1.53	117	106	7.0	198				
54	25.0	1532		1.4	1.64	1.64	119	107	7.5	199				
				1.5	1.76	1.76	118	108	8.0	199				
12	17.9	1550		1.4	1.64	1.64	119	108	8.0	199				
				1.4	1.64	1.64	119	109	8.0	200				
0	10.7	1608		1.4	1.65	1.65	120	109	9.0	201				
				1.4	1.65	1.65	119	110	9.5	201				
08	3.6	1626		0.9	1.06	1.06	118	109	7.5	201				
26		1644	315.320	0.9	1.06	1.06	119	110	7.5	201				
														Estimates:
														MW = 29.2
														%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	9.5	0.005

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

TIME = 126 min
VOLUME = 89.309 dcf
$(\Delta P)_{avg}$ = 1.2
[illegible]

$(T_{meter})_{avg}$ = 112°F
[illegible]

velocity = 69.2 ft/sec
ISO = 100.1 %

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

Page 4 of 4

CLIENT Battelle/DOE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 1.734	HOT/COLD BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-719	METER CORRECTION (Y) 0.9832	PROBE NO. 10-4
PROJECT NO. 93C0028-01	NOZZLE (SIZE,#) 0.197 #618	CALIBRATION DATE 5-17-93	FILTER NO. #3
TEST CREW JPS, TM	STATIC PRESSURE 0.5" H_2O	PITOT CORRECTION 0.84	STACK DIA. 56" (depth) x
BAROMETRIC PRESSURE 29.10	PORT DIRECTION D	CONTROL BOX NO. 5	PORT SIZE 99" (width)

Time	Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
0	46.4	1656	315.485	0.9	1.06	1.06	115	110	9.5	203	~250°F	<68°F	~250°F	18 min./point
				0.9	1.06	1.06	118	109	6.5	203				
18	39.3	1714		0.9	1.06	1.06	118	109	9.5	203				Readings every
				0.9	1.06	1.06	117	110	11.0	203				9 min
36	32.1	1732		1.1	1.30	1.30	117	110	13.5	204				
				1.1	1.30	1.30	115	110	12.5	204				
54	25.0	1750		1.1	1.30	1.30	116	110	12.0	203				
				1.1	1.30	1.30	116	110	11.0	203				
72	17.9	1808		1.2	1.42	1.42	117	110	11.5	203				
				1.2	1.42	1.42	118	110	11.0	204				
90	10.7	1826		1.2	1.42	1.42	117	110	14.5	203				
				1.2	1.42	1.42	112	109	16.5	203				
108	3.6	1844		1.2	1.40	1.40	109	108	17.0	202				
126		1902	400.000	1.2	1.40	1.40	108	108	17.0	202				
														Estimates:
														MW= 29.2
														%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	17.0	0.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Page # check

TIME = 126 min
VOLUME = 84.515 dcf
$(\Delta P)_{AVG}$ = 1.1
ΔH 1.2

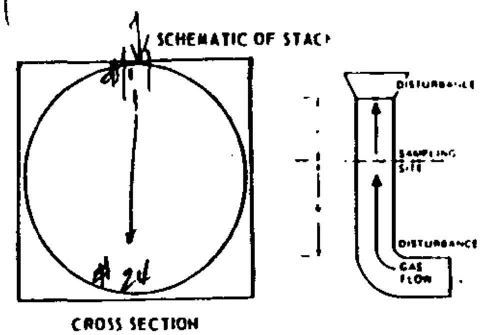
Thimble Ave = 112°F

velocity = 66.5 ft/sec
Iso. = 99.1%

AQE 6/92

#1

PARTICULATE FIELD DATA N-18-MUM-722



PLANT Niles
DATE 7-22-93
LOCATION 34 IN #15
OPERATOR Webb / sof
STACK NO
RUN NO. 4 MUM
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Approx. Time STATIC PRESSURE (in. H_2O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	Pot / Probe TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F		PUMP VACUUM in. Hg gauge	Last Imp VELOCITY
	0	09:25						660				#1	#2		
1									See Rolling row						
2									of gas meter						
3	24		384	.35	3.1	.46	.46		111	109	248	255	254	3	65
4	32		414	.48		.68	.68	656.9							
5	40		415	.55		.78	.78								
6	48		417	.62	3.4	.90	.90	665.2	133	130	258	264	259	5	74
7	56		414	.69		.99	.99								
8	4	10:32	414	.94		1.05	1.05	680.1							
9	12		416	.78		1.1	1.1								
10	20		409	.80	3.5	1.12	1.12	689.0	131	129	251	263	258	8	67
11	28		396	.85		1.2	1.2	691.0	117	115					
12	36		397	.90		1.29	1.29	694.7	113	111	245	246	253	5½	32
TOTAL															
AVERAGE															

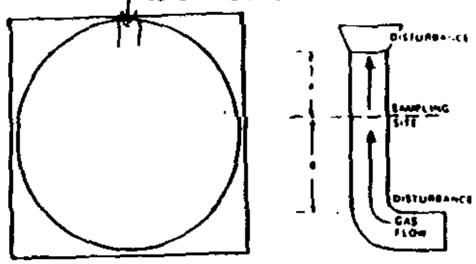
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS Pre leak check .01 cfm at 20"Hg

#2

PARTICULATE FIELD DATA



PLANT Niles
DATE 7-22-93
LOCATION BH IN #18
OPERATOR Webb/Cox
STACK NO.
RUN NO 4 MUM
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time / STATIC PRESSURE (in H₂O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F Box #1	Probe #2	PUMP VACUUM in. Hg gauge	Last Imp VELOCITY
17	49		388	.95		1.38	1.38	699.2	112	109	246	248	255	10	53
14	52		390	.85		1.1	1.1	703.6							
15	60	11:20	392	.90		1.12	1.12	709.1	110	107	246	249	257	10½	58
16	8		396	.90	3.3	1.12	1.12								
17	16		401	.95		1.05	1.05	720.6	108	104	249	252	258	11½	63
18	24	11:53	402	.72		1.0	1.0	~~723.7~~							
19	32		403	.72	3.3	1.0	1.0	729.7	106	102	247	252	259	12	67
20	40		405	.87		.95	.95	734.2							
21	~~48~~														
22	~~56~~	(A)	Steel structure in way of probe pitot tube; run 32 min on pt #24												
23	~~64~~														
24	32 F		406	.4	3.3	.55	.55	740.0	107	102	248	252	266	10	78
		12:43			Stop			752.405							
TOTAL	192 min														
AVERAGE	on vertical traverse														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

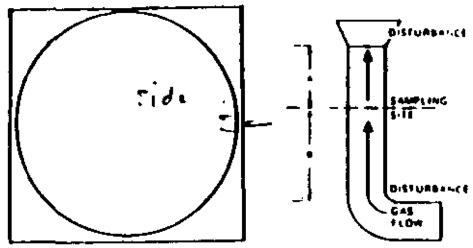
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS (A) Cross member has been a problem with last 3 pts on vertical traverse for all previous runs

#3

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 7-22-93
LOCATION BH in, # 18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 4 MUM
SAMPLE BOX NO
METER BOX NO. X-40513

AMBIENT TEMPERATURE 84
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215"
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time / STATIC PRESSURE (in H₂O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	$\sqrt{\Delta P_s}$ / % O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#2 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	#3 SAMPLE BOX TEMPERATURE °F	Plot TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	Probe	PUMP VACUUM in. Hg gauge	Leak / Imp / VELOCITY
	0	14:50	250					~~752.54~~				#8	#2		
1	7	no flow indicated			pt #7										
~~8~~															
~~2~~	~~8~~16	14:06	250	.3		.9	.9	752.54							
3	24		360	.5	3.1	.66	.66	758.9	103	101	241	251	254	5 1/2	52
4	32	14:22	366	.62		.82	.82								
5	40		367	.70		.94	.94	767.6							
6	48	14:38	367	.78		~~1.05~~	1.05	772.5	107	103	243	253	252	6	56
7	56		366	.52		1.1	1.1	776.7						6	
8	4	14:55	367	.84	3.0	1.1	1.1								
9	12		368	.79		1.12	1.12	786.8	109	104	243		252	6 1/2	59
10	20		370	.75		1.2	1.2	791.7							
11	28	15:11	374	.75		1.2	1.2	796.5	110	104	241	251	254	8	62
12	36		380	1.1		1.4	1.4	802.1							
TOTAL	96 min														
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

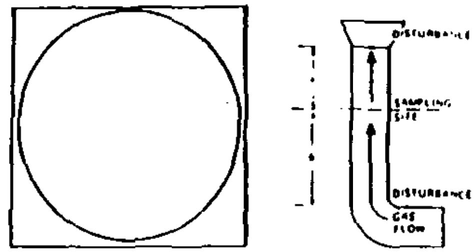
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS:
• Filter, flange and empty Condensate #1 emp
• Leak check at 12" Hg 0.01 cfm

#A

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Miller
DATE 11-22-95
LOCATION BH 101 #18
OPERATOR Webb / Cox
STACK NO. ____
RUN NO. 4 MUM
SAMPLE BOX NO. ____
METER BOX NO. X-4573

AMBIENT TEMPERATURE 54
BAROMETRIC PRESSURE 29.15
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. .215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE ____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time STATIC PRESSURE (in. H_2O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#1 OUTLET ($T_{m_{out}}$), °F	#13 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F #8	#2	PUMP VACUUM in. Hg gauge	last Imp VELOC
13	44	15:33	401	.05	3.1	1.2	1.2	808.1	112	105	242	252	255	9	67
14	52	.	409	.92		1.1 .90	1.1 .90	813.1							
15	60		416	.85		1.0	1.0	717.8	111	105	242	248	252		71
16	8			.75		1.0	1.0	821.0							
17	16		421	.87	3.0	.98	.98	827.1	110	107	242	251	251	10½	67
18	24		422	.80		.93	.93	833.1							
19	32		425	.80		.93	.93								
20	40		421	.78		1.05	1.05	891.9	110	107	243	253	258	10	78
21	48		430	.72		.84	.84	846.2							
22	56		437	.70		.82	.82								
23	4		435	.65		.76	.76	856.2	109	104	244	263	262	11	74
24	12		434	.57	3.2	.80	.80	863.128	STOP						
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS: ~~[illegible]~~
Post-leak check at 12" = .01 cfm
with flex line
including S/S at 7" = .01 cfm

NOMOGRAPH DATA

PLANT Niles, Ohio SNOX process

DATE 7/22/93

SAMPLING LOCATION outlet of bag house

N-19-MVM-722

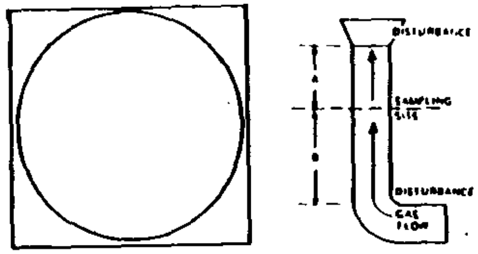
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.20
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	380
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	1.00
C FACTOR	0.90	
CALCULATED NOZZLE DIAMETER, in.	0.260	
ACTUAL NOZZLE DIAMETER, in.	0.247	
REFERENCE Δp, in. H_2O	0.85	

EPA (Dur) 234
4/72

#1

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE 7/22/93
LOCATION outlet of baghouse
OPERATOR Leonard, Hupp
STACK NO.
RUN NO. N-19-MVM-722
SAMPLE BOX NO
METER BOX NO X-40513

AMBIENT TEMPERATURE 80°
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8 ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER $\Delta H_@$ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp, °F (STATIC PRESSURE in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	probe outlet	SAMPLE BOX TEMPERATURE, °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F	PUMP VACUUM, in. Hg gauge	O_2 % (VELOCITY fps)
1	0/9:07			0.43	0.91	0.91	323.468						5.2	
2	10/9:17	230	339	0.48	1.00	1.00	328.9	79	74		260	53	5.2	3.4
3	20/9:27	282	376	0.48	0.99	0.99	334.8	83	77		261	53	5.2	3.5
4	30/9:37	255	382	0.47	0.99	0.99	340.0	86	80		262	54	5.3	3.7
5	40/9:47	256	383	0.48	1.0	1.0	345.7	89	82		264	55	5.35	3.7
6	50/9:57	248	383	0.65	1.40	1.40		92	86	244	262	56	6.0	3.5
7	60/10:07	259	382	0.70	1.50	1.50	357.5	93	86	252	261	55	6.2	4.1
8	70/10:17	261	384	0.58	1.25	1.25	364.6	95	88	260	261	54	6.1	3.6
9	80/10:27	258	384	0.57	1.20	1.20	371.2	97	91	262	262	58	6.25	3.6
10	90/10:37	260	383	0.6	1.29	1.29	377.8	99	93	264	262	58	6.5	3.6
11	100/10:47	260	384	0.62	1.3	1.3	384.35	100	94	265.6	261	58	6.6	3.8
12	110/10:57	259	382	0.65	1.4	1.4	391.4	96	95	253.0	258	51	6.9	3.75
13	120/11:07	285	383	0.65	1.4	1.4	398.2	94	90	224.0	258	51	6.9	3.5
14	130/11:17	357	383	0.91	1.90	1.90	404.6	94	90	228	259	54	7.5	4.1
15	140/11:27	403	383	0.96	2.00	2.00		98	92	246	261	57	7.8	4.0
TOTAL														
AVERAGE														

heated line = 256

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

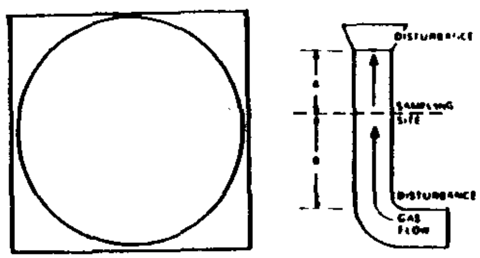
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

2

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOXSNOX
DATE 7/22/93
LOCATION outlet of baghouse
OPERATOR Leonard, Hupp
STACK NO
RUN NO. N-19-MUM-72A
SAMPLE BOX NO. #1
METER BOX NO. X-40513

AMBIENT TEMPERATURE 79
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 7
PROBE LENGTH, in 9ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. RRC
PROBE HEATER SETTING 390°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H_2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	probe outlet	SAMPLE BOX TEMPERATURE	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % ~~VELOCITY~~
16	150/11:37	404	383	0.85	1.80	1.80	420.7	100	94	256	262	58	2.6	3.6
17	160/11:47	404	385	0.83	1.75	1.75	428.0	75	91	255	260	59	2.5	3.5
18	170/11:57	404	383	0.66	1.40	1.40	436.0	96	92	259	261	60	6.8	3.5
19	180/12:07	403	382	0.60	1.30	1.30	442.7	95	91	248	260	58	6.5	3.7
20	190/12:17	404	384	0.43	0.92	0.92	449.4	99	94	256	262	58	5.5	3.9
21	200/12:27	403	382	0.37	0.78	0.78	455.1	99	94	248	262	61	5.1	3.7
22	210/12:37	404	383	0.51	1.10	1.10	460.3	100	96	246	261	63	5.9	4.2
23	220/12:47	403	382	0.31	0.66	0.66	466.1	100	96	250	260	61	5.0	3.9
24	230/12:57	403	382	0.30	0.64	0.64	471.0	100	96	235	261	59	5.0	3.9
	240/13:07	off					475.659							
SIDE														
1	240/14:00	on		0.21	0.45	0.45	475.659	91	91	237	260	67	4.5	4.2
2	250/14:10	268		0.34	0.72	0.72	479.8	94	93	200	261	64	5.0	3.7
3	260/14:20	321	375	0.36	0.77	0.77	484.7	98	94	281	259	63	5.2	4.1
4	270/14:30	289	376	0.57	1.20	1.20	489.9	97	93	242	258	63	5.2	4.0
TOTAL														
AVERAGE														

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

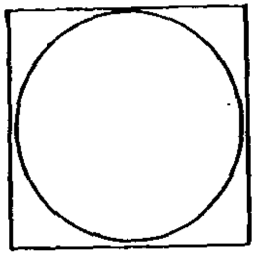
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

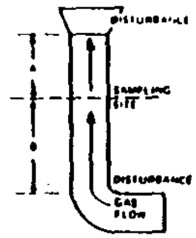
COMMENTS

#3 (~~[illegible]~~)

PARTICULATE "IELD DATA

SCHEMATIC OF STACK





CROSS SECTION

PLANT Niles Ohio wax process
DATE 7/22/93
LOCATION outlet of baghouse
OPERATOR Lemerl, Kupp
STACK NO. ______
RUN NO. N-19-MUM-722
SAMPLE BOX NO #1
METER BOX NO. X-40513

AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8ft.
PROBE HEATER SETTING 390°F
HEATER BOX SETTING 260°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE, °F probe outlet		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F	PUMP VACUUM, in. Hg gauge	O_2 % ~~VELOCITY fps~~
5	280/14:40	307	383	0.50		1.10	1.10	495.3	99	95	265	260	60	6.0	4.2
6	290/14:50	300	384	0.55		1.20	1.20	501.0	100	95	261	259	59	6.1	4.3
7	300/15:00	302	385	0.56		1.20	1.20	507.1	101	96	264	259	63	6.1	4.1
8	310/15:10	303	384	0.55		1.20	1.20	513.6	101	97	268	258	65	6.2	4.2
9	320/15:20	302	385	0.53		1.15	1.15	519.6	102	98	262	260	59	6.2	4.2
10	330/15:30	302	385	0.57		1.20	1.20	526.6	103	99	261	260	58	6.2	4.0
11	340/15:40	296	384	0.59		1.25	1.25	532.7	101	98	268	258	58	6.2	4.2
12	350/15:50	282	385	0.73		1.60	1.60	539.1	103	99	273	259	60	6.2	3.9
13	360/16:00	307	386	0.80		1.70	1.70	546.5	107	102	282	261	61	7.0	4.1
14	370/16:10	362	386	0.80		1.70	1.70	552.7	109	102	241	262	56	7.2	4.1
15	380/16:20	381	386	0.80		1.70	1.70	560.3	110	104	221	262	54	7.5	4.2
16	390/16:30	397	385	0.76		1.65	1.65	56	111	105	243	262	54	7.5	4.4
17	400/16:40	403	385	0.72		1.60	1.60	575.5	111	105	247	262	58	7.5	4.2
18	410/16:50	402	385	0.75		1.60	1.60	582.9	112	106	250	262	60	7.6	4.5
19	420/17:00	400	384	0.77		1.70	1.70	590.3	110	105	253	260	60	7.7	4.3
TOTAL															
AVERAGE															

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

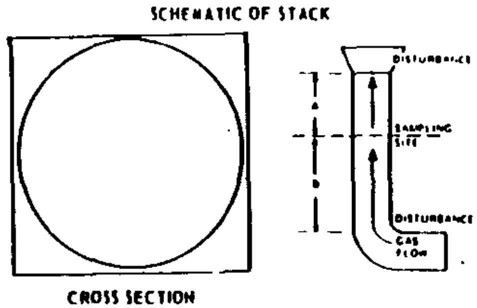
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#4

PARTICULATE "ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles Ohio SNOX process
DATE 7/22/93
LOCATION outlet of baghouse
OPERATOR Lemark, Kupp
STACK NO. ______
RUN NO. N-19-MUM-722
SAMPLE BOX NO 1
METER BOX NO Y40513

AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE 29.20
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 9ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 880.
PROBE HEATER SETTING 390°F
HEATER BOX SETTING 250°F

METER ΔH@ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WAS
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H₂O)~~	STACK TEMPERATURE (T_S), °F	VELOCITY HEAD (ΔP_S)	($\sqrt{\Delta P_S}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	outlet probe °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % ~~VELOCITY fps~~
20	430/17:10	401	384	0.57		1.2	1.2	598.0	112	107	255	262	63	7.0	4.2
21	440/17:20	400	385	0.58		1.25	1.25	604.6	113	107	254	263	66	7.0	4.2
22	450/17:30	401	384	0.60		1.25	1.25	611.3	112	108	254	264	68	7.0	4.0
23	460/17:40	401	382	0.54		1.15	1.15	617.9	111	107	256	263	69	6.8	4.0
24	470/17:50	401	383	0.52		1.10	1.10	624.8	110	106		262	66	6.5	4.5
	480/18:00	off						630.693							
TOTAL															
AVERAGE															

leak check 0.028 at 8.5" Hg

COMMENTS

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR 2/6
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thurs).
TEST NO. N-20-MM-722
NOZZLE (SIZE,#) 0.[illegible]
STATIC PRESSURE [illegible] H2O
PORT DIRECTION Port [illegible]

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. THREE

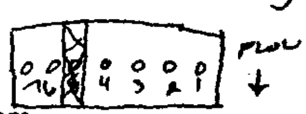
HOT BOX NO. 6
COLD BOX NO. 6
PROBE NO. 13-A
FILTER NO. Various
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	09:08	181.490	.04	.64	.64	80	80	1.0	641	~250°F	<68°F	~~[illegible]~~	20 [illegible]
			.04	.64	.64	98	82	1.0	630			~300°F	
			.04	.64	.64	97	85	1.0	630				
			.04	.64	.64	101	86	1.0	629				
90"			.10	1.61	1.61	104	91	1.5	629				
			.10	1.61	1.61	111	93	1.5	630				
			.10	1.61	1.61	111	94	1.5	631				
			.04	.64	.64	114	96	1.0	632				
70"			.04	.64	.64	112	96	1.0	632				
			.04	.64	.64	112	96	1.0	633				
			.06	.96	.96	113	99	1.5	635				
			.06	.96	.96	113	99	1.5	633				
50"			.03	.48	.48	112	99	1.0	633				
			.03	.48	.48	112	99	1.0	633				
			.03	.48	.48	111	99	1.0	638				Estimates:
			.03	.48	.48	111	99	1.0	635				MW=29.2
30"			.03	.48	.48	110	99	1.0	634				%H2O=9
			.03	.48	.48	111	99	1.0	635				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.015cfm
After	18.0	<0.02cfm

1ST PM



PITOT LEAK CHECK

	Positive	Negative
Before	OK/15sec	OK/15sec
After		

	1	2
CO2	14.0	14.0
O2	6.0	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	Empty ~~[illegible]~~	746.2	432.6	313.6
2.	150mL HNO3/H2O2	834.1	609.6	224.5
3.	150mL HNO3/H2O2	672.1	633.3	38.8
4.	Empty	465.6	462.3	3.3
5.	100mL KMnO4	558.8	558.8	0.0
6.	100mL KMnO4	496.7	498.5	-1.8
7.	200g Silica Gel	[illegible]	6	VS.

629.2 total

Actual Moisture = 8.9

50.R
1F

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / AOE
TEST UNIT SCR Reactor outlet
PROJECT NO. 93C029-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.38

TEST DATE 07-22-93 (Texas)
TEST NO. N-20-MUM-723
NOZZLE (SIZE,ID) 0.440"
STATIC PRESSURE -12.9 " H2O
PORT DIRECTION Port # 3

ORIFICE CORRECTION 1.573
METER CORRECTION 1.0157
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Three

HOT BOX NO. 6
COLD BOX NO. 6
PROBE NO. 13-7
FILTER NO. unweighed
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			-.03	.48	.49	112	106	1.0	645	~280°F	68°F	~300°F	
			.05	.80	.80	111	100	1.0	630				
red"			.05	.80	.80	113	100	1.0	630				
			.05	.80	.80	113	100	1.0	635				
			.05	.80	.90	113	100	1.0	635				
	11:08	243.975	.05	.10	.80	113	100	1.0	611				
110"	11:18	243.975	.06	.96	.96	95	99	1.0	642				
			.06	.96	.96	110	89	1.0	646				
			.07	1.12	1.12	110	90	2.0	641				
			.10	1.61	1.61	115	95	4.0	640				
90			.10	1.61	1.61	116	99	4.5	647				
			.10	1.61	1.61	116	94	4.5	653				
			.10	1.61	1.61	116	100	4.5	658				
			.10	1.61	1.61	116	99	4.5	659				Estimates:
70			.10	1.61	1.61	116	100	5.5	653				MW= 29.0
			.10	1.61	1.61	116	100	6.0	651				%H2O= 9
			.09	1.45	1.45	116	100	6.5	655				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-22-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	6
TEST UNIT	SCR Reactor Outlet	TEST NO.	U-20-MUM-722	METER CORRECTION	1.015	COLD BOX NO.	6
PROJECT NO.	93C028-01	NOZZLE (SIZE, #)	0.440"	CALIBRATION DATE	07-02-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	RPC	STATIC PRESSURE	[illegible] " H2O	PITOT CORRECTION	0.84	FILTER NO.	[illegible]
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	[illegible] 3, 4	CONTROL BOX NO.	THREE	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.09	1.45	1.45	117	100	6.5	655	~250°F	68°F	~300°F	[illegible]
50			.10	1.61	1.61	117	100	6.5	656				
			.10	1.61	1.61	116	100	7.0	659				
			.10	1.61	1.61	117	102	7.0	659				
			.10	1.61	1.61	117	103	8.0	656				
30			.10	1.61	1.61	118	103	10.5	659				
			.10	1.61	1.61	115	100	14.0	654				
			.10	1.61	1.61	114	100	15.0	654				
			.11	1.77	1.77	109	99	[illegible]	659				
10			.11	1.77	1.77	109	88	18.0	630				
			.10	1.61	1.61	110	89	16.5	629				
			.095	1.53	1.53	108	98	15.0	629				Changed filter
	13:18	328.128	.16	1.61	1.61	110	98	15.0	630				at 13:18
110"	13:31	328.750	.12	1.93	1.93	98	98	2.0	660				Estimates:
			.15	2.41	2.41	117	99	3.0	668				MW= 29.2
			.15	2.41	2.41	118	99	3.0	668				%H2O= 9
			.15	2.41	2.41	120	101	3.0	666				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

2nd pt

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 07-22-93	ORIFICE CORRECTION 1.572	HOT BOX NO. 6
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MUM-722	METER CORRECTION 1.0151	COLD BOX NO. 6
PROJECT NO. 93C028-01	NOZZLE (SIZE,ft) 0.440"	CALIBRATION DATE 07-02-93	PROBE NO. 13-2
CONTROL BOX OPERATOR RPC	STATIC PRESSURE -1.0 " H2O	PITOT CORRECTION 0.84	FILTER NO. Unweighed
BAROMETRIC PRESSURE 29.38	PORT DIRECTION Port 4	CONTROL BOX NO. Three	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"			.07	1.12	1.12	121	101	1.5	675	~210	68°F	~300°F	[illegible]
			.10	1.61	1.61	118	101	2.5	678				
			.10	1.61	1.01	116	101	2.5	678				
			.06	.96	.96	117	102	1.5	678				
70"			.08	1.28	1.28	118	102	2.0	680				
			.15	2.41	2.41	120	103	3.0	681				
			.15	2.41	2.41	123	103	3.0	681				
			.10	1.61	1.61	121	104	2.5	681				
50"			.09	1.45	1.45	121	104	3.0	681				
			.07	1.12	1.12	121	104	2.0	682				
			.07	1.12	1.12	118	105	1.5	682				
30			.07	1.12	1.12	118	104	1.0	683				
30			.13	2.09	2.09	118	105	3.5	687				
			.13	2.09	2.09	123	105	3.5	687				
			.13	2.09	2.09	124	105	3.5	687				Estimates:
			.15	2.41	2.41	124	105	4.0	687				MW= 29.2
10			.15	2.41	2.41	126	106	4.0	685				%H2O= 9
			.06	.96	.96	124	106	1.5	685				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-20-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	6
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-MUM-722	METER CORRECTION	1.0151	COLD BOX NO.	6
PROJECT NO.	93C628-01	NOZZLE (SIZE,#)	0.440	CALIBRATION DATE	07-02-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	RPC	STATIC PRESSURE	17.0" H_2O	PITOT CORRECTION	0.84	FILTER NO.	[illegible]
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	Port 4, 6	CONTROL BOX NO.	[illegible]	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.07	1.12	1.12	121	106	2.0	685	~280°	<68° [illegible]	@ 250°F	[illegible]
	1531	418.980	.07	1.12	1.12	121	106	2.0	680				
110	1546	48.980	.04	.64	.64	107	108	1.0	681				
			.06	.96	.96	113	104	1.0	691				
			.07	1.12	1.12	117	104	1.0	690				
~~80~~			.07	1.12	1.12	118	104	1.0	691				
90			.13	2.09	2.09	120	104	2.0	694				
			.12	1.93	1.93	121	104	2.5	697				
[illegible]			.12	1.93	1.93	121	103	2.5	697				
			.12	1.93	1.93	121	103	2.5	698				
70			.13	2.09	2.09	122	104	3.0	699				
~~60~~			.12	1.93	1.93	122	104	2.0	700				
			.06	.96	.96	122	104	1.0	700				
			.06	.96	.96	123	104	1.0	699				
50			.08	1.28	1.28	117	103	1.5	700				Estimates:
			.12	1.93	1.93	117	103	3.0	701				MW= 29.2
			.11	1.77	1.77	122	103	2.5	701				%H2O= 9
			.10	1.61	1.61	120	104	2.0	701				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-22-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	6
TEST UNIT	SCR Reactor outlet	TEST NO.	N-20-MM-728	METER CORRECTION	1.0181	COLD BOX NO.	6
PROJECT NO.	93C428-01	NOZZLE (SIZE,#)	0.440	CALIBRATION DATE	07-02-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	EFC	STATIC PRESSURE	12.0" H2O	PITOT CORRECTION	0.84	FILTER NO.	unlubricated
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	Port #2	CONTROL BOX NO.	Three	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
30			.10	1.61	1.61	122	104	2.0	701	~250	68F	~300°	20 min/pt
			.10	1.61	1.61	123	104	2.0	700				
			.12	1.93	1.93	120	104	2.0	701				
			.12	1.93	1.93	121	103	2.5	701				
10"			.13	2.09	2.09	121	104	3.5	701				
			.13	2.09	2.09	122	104	3.5	698				
	17:46	508.356	.15	2.41	2.41	122	104	3.5	700				
	Δ=8 hr	Δ=326.244		(ΔH)avg =		(Tmeter)avg = 108°F			(Tstack)avg = 664°F				
	=480	dcf	(Δp)avg =		1.42								
	min												
			0.085						velocity = 23.5 ft/sec				
									ISO. = 97.1%				Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

Page 1 of 4

CLIENT Battelle /DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR JB
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thur.)
TEST NO. N-21-MUM-722
NOZZLE (SIZE,#) 0.197, G18
STATIC PRESSURE 0.8" H₂O
PORT DIRECTION A

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 5
COLD BOX NO.
PROBE NO. 10-4
FILTER NO.
STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	0906	676.724	0.7	0.80	0.80	94	92	2.0	203	~250°F	48°F	~250°F	18 min/point
			0.7	0.80	0.80	101	92	1.5	200				
39.3	0924		0.7	0.81	0.81	107	95	1.5	199				Readings every
			0.7	0.81	0.81	110	98	1.5	200				9 min
32.1	0942		0.8	0.93	0.93	115	102	1.5	198				
			0.8	0.93	0.93	117	105	1.5	197				
25.0	1000		1.0	1.17	1.17	119	106	1.5	197				
			1.0	1.17	1.17	118	106	1.5	200				
17.9	1018		1.0	1.17	1.17	118	106	1.5	200				
			1.0	1.17	1.17	118	105	1.5	199				
10.7	1036		1.0	1.17	1.17	118	106	1.5	197				
			1.0	1.17	1.17	119	106	1.5	201				
3.6	1054		0.7	0.82	0.82	118	106	1.0	203		velocity = 56.3 ft/sec		
	1112	750.410	0.7	0.82	0.82	117	106	1.0	203				
											Iso. =	102.2%	Estimates:
													MW = 29.2
	Δ = 126 min	Δ = 73.686 dcf	$(\Delta P)_{avg}$ = 0.8	$(\Delta H)_{avg}$ = 0.98		$(T_{meter})_{avg}$ = 108°F			$(T_{stack})_{avg}$ = 200°F				%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DOM Rate (cfm)
Before	5.0	<0.010
After	5.0	0.010

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	OK	OK
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1. pH	~~[illegible]~~	693.0	452.9	240.1
2.	100 mL HNO₃/H₂O₂	688.0	540.4	147.6
3.	150 mL HNO₃/H₂O₂	584.0	562.4	21.6
4.	Empty	471.5	466.1	5.4
5.	100 mL KMnO₄	556.7	558.1	-1.4
6.	100 mL KMnO₄	552.3	553.0	-0.7
7.	200 g Silica Gel	721.2	677.9	43.3

455.9 g

Actual Moisture = 8.1%

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-
CONTROL BOX OPERATOR JD
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thurs.)
TEST NO. N-21-MUM-722
NOZZLE (SIZE,#) 0.177 G18
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION B

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 6

HOT BOX NO. 5
COLD BOX NO.
PROBE NO. 10-4
FILTER NO.
STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1120	750.560	0.8	0.93	0.93	108	104	1.0	199	~250°F	<68°F	250°F	18 min/point
			0.9	1.04	1.04	114	103	1.0	202				
39.3	1138		0.9	1.05	1.05	116	104	1.0	202				Readings every 9 minutes
			0.7	0.82	0.82	115	103	1.0	197				
32.1	1156		0.9	1.05	1.05	115	103	1.0	193				
			0.9	1.05	1.05	117	104	1.5	196				
25.0	1214		0.9	1.06	1.06	116	104	1.5	195				
			0.9	1.06	1.06	118	105	1.5	195				
17.9	1232		0.7	0.83	0.83	118	106	1.0	196				
			0.9	1.06	1.06	119	106	1.5	196				
10.7	1250		0.6	0.71	0.71	119	107	1.0	196				
			0.6	0.71	0.71	119	107	1.0	196				
3.6	1308		0.4	0.47	0.47	118	108	1.0	198				
	1326	819.881	0.4	0.47	0.47	117	107	1.0	199				
													Estimates:
	Δ=126 min	Δ=69.321 dcf	$(\sqrt{\Delta P})_{avg}$ =	$(\Delta H)_{avg}$ = 0.88		$(T_{meter})_{avg}$ = 111°F			$(T_{stack})_{avg}$ = 197°F				MW= 29.2
													%H2O= 8.5
			0.7					velocity =	52.5 ft/sec	Iso. = 102.6%			

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	5.0	0.015

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQB 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO 93C028-01
CONTROL BOX OPERATOR JPS
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thus.)
TEST NO. N-21-MUM-722
NOZZLE (SIZE,#) 0.197 618
STATIC PRESSURE 0.8" H2O
PORT DIRECTION C

ORIFICE CORRECTION 1.734
METER CORRECTION 0.9832
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 5

HOT BOX NO. 5
COLD BOX NO.
PROBE NO. 10-4
FILTER NO.
STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1334	820.075	0.4	0.47	0.47	110	107	1.0	199	~250°F	<68°F	~250°F	18 min/point
			0.5	0.59	0.59	114	106	1.0	198				
39.3	1352		0.5	0.59	0.59	115	105	1.0	198				Readings every
			0.5	0.59	0.59	116	105	1.0	199				9 minutes
32.1	1410		0.5	0.59	0.59	116	106	1.0	199				
			0.5	0.59	0.59	117	107	1.0	200				
25.0	1428		0.5	0.59	0.59	118	107	1.0	200				
			0.5	0.59	0.59	117	108	1.0	201				
17.9	1446		0.5	0.59	0.59	118	107	1.0	200				
			0.5	0.59	0.59	118	108	1.0	199				
10.7	1504		0.5	0.59	0.59	118	107	1.0	199				
			0.5	0.59	0.59	118	107	1.0	200				
3.6	1522		0.3	0.35	0.36	117	108	1.0	200				
	1540	874.000	0.3	0.35	0.35	116	107	1.0	199				
													Estimates:
	Δ=126	Δ=53.925	$(\Delta P)_{avg}$ =	$(\Delta H)_{avg}$	=0.58	$(T_{meter})_{avg}$	=112°F		$(T_{stack})_{avg}$	= 199°F			MW= 29.2
	min	dft³											%H2O= 8.5%
			0.5			velocity	= 44.5 ft/sec		Iso.	= 93.8%			

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	5.0	0.010

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-22-93 (Thurs.)	ORIFICE CORRECTION 1.734	HOT BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-722	METER CORRECTION 0.9832	COLD BOX NO.
PROJECT NO. 93C4228-01	NOZZLE (SIZE,in) 0.197 GB	CALIBRATION DATE 5-17-93	PROBE NO. 10-4
CONTROL BOX OPERATOR JTS	STATIC PRESSURE 0.8" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION D	CONTROL BOX NO. 5	STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1549	874.140	0.3	0.35	0.35	109	107	1.0	200	~250°F	48°F	~250°F	18 min/point
			0.3	0.35	0.35	114	107	1.0	201				
39.3	1607		0.8	0.94	0.94	117	106	1.5	198				Readings every
			0.8	0.94	0.94	118	106	1.5	198				9 minutes
32.1	1625		1.0	1.17	1.17	119	107	2.0	196				
			1.0	1.17	1.17	120	107	2.0	198				
25.0	1643		1.0	1.17	1.17	121	108	2.0	196				
			1.0	1.17	1.17	122	108	2.0	197				
17.9	1701		1.0	1.17	1.17	121	109	2.0	198				
			1.0	1.17	1.17	123	109	2.0	197				
10.7	1719		1.2	1.40	1.40	133	114	2.0	198			← pump exhaust	
			1.2	1.43	1.43	142	117	2.0	198			fan died	
3.6	1737		1.1	1.31	1.31	140	123	2.0	197				
	1755	949.113	1.1	1.31	1.31	147	125	2.0	197				
													Estimates:
	θ=126 min	Δ=74.973 dry ft³	$(\Delta P)_{avg}$ = 0.9		$(\Delta H)_{avg}$ = 1.08	$(T_{meter})_{avg}$ = 118°F			$(T_{stack})_{avg}$ = 198°F				MW= 29.2
						Velocity = 59.6 ft/sec			Iso. = 96.3%				%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After	5.0	0.010

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

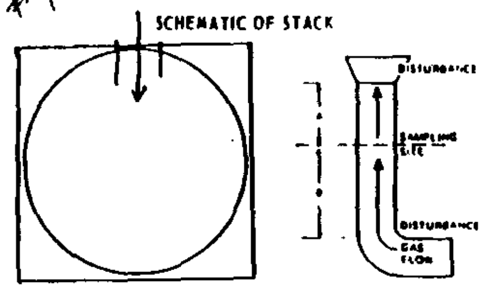
	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

#1

SCHEMATIC OF STACK



CROSS SECTION

PARTICULATE FIELD DATA

N-18-MUM-724

PLANT Niles
DATE 7-24-93
LOCATION BH IN #18
OPERATOR Webb / Cox
STACK NO.
RUN NO. 6 MUM
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 77
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER $\Delta H_@$ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE W/
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time (~~STATIC PRESSURE (in. H2O)~~)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Filt	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F (Filter)	°F	PUMP VACUUM in. Hg gauge	VELOCITY
	0	08:55						99.116			#8	#2	#3	#9		
1	–	20	Flow indication		H#1											
2	16	09:11	276	.25	2.4	.35	.35		90	89	254	254	246	54	2½	
3	24	09:19	332	.4	2.6	.58	.58	100.2								
4	32	09:27	395	.5		.72	.72	103.8								
5	40	09:35	407	.6	3.3	.89	.88		99	93					5	
6	48	09:43	405	.68		1.0	1.0									
7	56	09:51	400	.70		1.0	1.0									
8	4	09:59	400	.75	3.0	1.1	1.1	121.7	104	96	251	254	246	50	5½	
9	12	10:07	400	.80		1.12	1.12									
10	20	10:15	401	.82		1.2	1.2	132.2								
11	28	10:23	401	.88	2.9	1.25	1.25	137.1	108	100	253	256	247	54	8	
12	36	10:31		.95		1.4	1.4									
TOTAL																
AVERAGE																

Hest filter .01 at 10" Hg

Pre leak check = .015 at 15" Hg

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

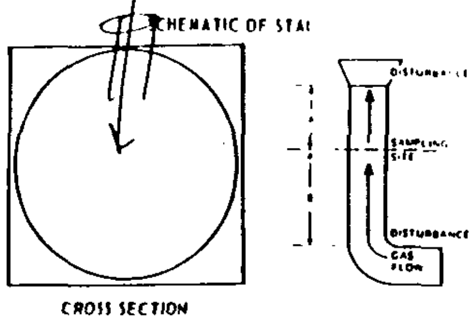
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

(R) Zero O_2 N_2 = −0.2
Rezero 0.0
Span − Air = 21.6
Ready 21.0
Span using 4.97 read 4.7
Adj to 4.9–5.0

#2

PARTICULATE FIELD DATA



PLANT Niles
DATE 7-24-93
LOCATION BH IN #18
OPERATOR Webb/Cox
STACK NO.
RUN NO. 6 MUM
SAMPLE BOX NO.
METER BOX NO X-40517

AMBIENT TEMPERATURE 77
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in H₂O)~~	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	Sun on Meter GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	Filter ~~SAMPLE BOX TEMPERATURE~~ °F	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR ~~LAST IMPINGER~~ Filter °F		PUMP VACUUM in. Hg gauge	VELOCI fps
					O_2						#1	#2	#3	#4		
13	44	10:39	392	.92		1.35	1.35	148.4	117	109						
14	52	10:47	398	.82		1.2	1.2	155.0								
15	60	10:55	401	.82		1.2	1.2	158.1	114	107	255	257	247	62	11	
16	8	11:03	400	.78	2.9	1.1	1.1	164.9								
17	16	11:11	405	.72		1.05	1.05	169.5	115	107	252	258	249	53	11 1/2	
18	24	11:19	407	.73		1.05	1.05	174.8								
19	32	11:27	411	.70	2.1	1.0	1.0	179.5	115	109	255	260	248	59	12	
20	40	11:35	408	.65		0.94	0.94	184.1								
21	-															
22	obstruction															
23	-															
24		12:	410	.35	3.6	0.50	0.50	189.0	109	106	253	258	246	63	10	
		12:07						202.445	Stop							
TOTAL																
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

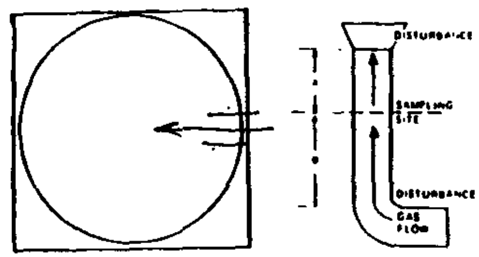
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS: Change filter and collect condensate from #1 Imp. Leak check at 12" Hg = .02

#3

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 7-24-93
LOCATION BH Fh #18
OPERATOR Webb/Cox
STACK NO.
RUN NO. 6
SAMPLE BOX NO.
METER BOX NO. X-40513

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. .215'
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.67
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time / STATIC PRESSURE (~~in. H₂O~~)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	O2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F Flex	Probe	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F Filter		PUMP VACUUM in. Hg gauge	VELOCITY lbs
	0	13:39						202.6			#8	#2	#3	#5		
1				0.25		.35	.35									
2	16	13:50	213						104	103	253	266	247	69	3	
3	24	13:58	341	0.50		.73	.70	208.8								
4	32	14:06	360	0.60		.84	.84	213.0								
5	40	14:14	368	0.70		1.00	1.00	217.5	109	104	254	251	241	70	5	
6	48	14:22	369	0.74	3.0	1.05	1.05									
7	56	14:30	372	0.78		1.10	1.10	228.2	115	109	250	252	248	67	6	
8	4	14:38	370	0.83	3.0	1.18	1.18	232.8								
9	12	14:46	371	0.84	3.0	1.22	1.22	237.5	115	109	251	251	246	60	6 1/2	
10	20	14:54	374	0.95		1.35	1.35	242.7								
11	28	15:02	374	0.98		1.38	1.38	247.7	117	110	253	254	248	65	9	
12	36	15:10														
TOTAL																
AVERAGE																

Leak A.R./O2

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

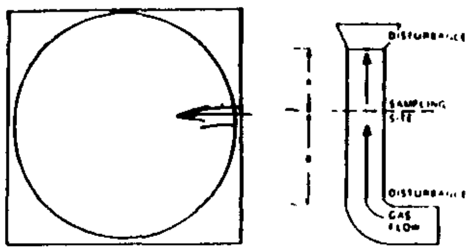
COMMENTS

O_2 Meter reading 24.5 on Air - Battery low go to power supply OK Set air at 21.0%.

#4

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles
DATE 2-24-93
LOCATION BH, IID #18
OPERATOR Webb/Cox
STACK NO —
RUN NO 6 MUM
SAMPLE BOX NO. —
METER BOX NO X-40513

AMBIENT TEMPERATURE 86
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 8
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in 0.215
STACK DIAMETER, in. 80
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@ 1.64
C FACTOR 0.9
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time STATIC PRESSURE (in. H₂O)	#4 STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	% O_2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	#6 GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	#7 OUTLET ($T_{m_{out}}$), °F	Flex SAMPLE BOX TEMPERATURE °F #8	Probe #2	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER Filter °F #3	#4	PUMP VACUUM in. Hg gauge	VELOCITY
13	44	15:18	394	0.98	2.6	1.38	1.38	259.8	119	112	254	255	249	70	10½	
14	52	15:26	408	0.92		1.28	1.28	265.7								
15	60	15:34	412	0.90		1.25	1.25	270.7	114	108	252	259	246	75	11	
16	8	15:42	414	0.82	2.8	1.15	1.15	276.2								
17	16	15:50	417	0.82		1.15	1.15	282.0	115	109	251	256	247	76	11	
18	24	15:58	423	0.82	2.9	1.15	1.15	287.1								
19	32	16:06	424	0.8		1.10	1.10									
20	40	16:14	426	.75		1.0	1.0									
21	48	16:22	428	.72		0.98	0.98									
22	56	16:30	430	.68	3.6	0.90	0.90	305.8	117	111	254	260	249	89	13	
23	4	16:38	431	0.62		0.83	0.83	311.4								
24	12	16:46	432	0.50		0.68	0.68	315.8	117	112	256	259	250	91?		
						STOP		319.448								
TOTAL																
AVERAGE																

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS: Post leak check .015cfm at 1

NOMOGRAPH DATA

PLANT Niles, Ohio Ohio Edison smax process

DATE 7/24/73

SAMPLING LOCATION outlet of bag house

N-19- MUM-724

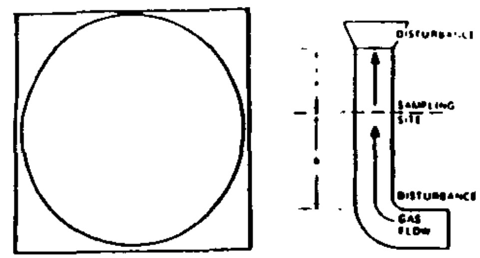
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m_{avg.}}$	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.14
STATIC PRESSURE IN STACK, in. Hg (P_m ±0.073 x STACK GAUGE PRESSURE in in. H_2O)	P_s	8.5" H_2O
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1.0
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	383
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	0.65
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	0.89
C FACTOR		0.90
CALCULATED NOZZLE DIAMETER, in.		0.260
ACTUAL NOZZLE DIAMETER, in.		0.247
REFERENCE Δp, in. H_2O		0.850

EPA (Dur) 234
4/72

#1

PARTICULATE FIELD DATA

SCHEMATIC OF STA[CK]



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE 7/24/93
LOCATION outlet of baghouse
OPERATOR Leonard Hupp
STACK NO ______
RUN NO. N-19-MVM-724
SAMPLE BOX NO. 1
METER BOX NO. X-40513

AMBIENT TEMPERATURE 70
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 7 ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8 ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER $\Delta H_@$ 1.66
C FACTOR 0.90
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, m[g]		
SAMPLE	FILTER	PROBE W[ASH]
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOC[ITY]
1	0/9:00	264	275	0.35	0.76	0.76	866.944	73	72	260	56	5.0	7.3
2	10/9:10	264	349	0.45	0.95	0.95	872.3	78	74	261	51	5.0	4.4
~~3~~ 2	~~20/9:20~~ / 9:16 power off						875.592						
	16/9:16			0.55	1.20	1.20	875.592	81	76	267	49		
3	20/9:22	258	381	0.60	1.25	1.25	877.9	82	76	259	49	5.5	4.0
4	30/9:32	260	380	0.60	1.25	1.25	884.4	86	79	260	49	5.5	4.5
5	40/9:42	261	384	0.65	1.40	1.40	890.9	87	80	260	49	6.0	4.5
6	50/9:52	259	384	0.65	1.40	1.40	897.5	88	82	260	49	6.0	4.0
7	60/10:02	260	384	0.56	1.20	1.20	904.4	89	83	260	50	6.0	4.0
8	70/10:12	258	384	0.56	1.20	1.20	910.7	89	83	260	52	6.0	4.0
9	80/10:22	259	385	0.56	1.20	1.20	917.1	91	86	261	53	6.0	4.0
10	90/10:32	260	386	0.56	1.20	1.20	923.5	92	87	261	54	6.0	4.0
11	100/10:42	260	384	0.56	1.20	1.20	929.9	94	88	261	56	6.0	4.0
12	110/10:52	259	386	0.56	1.20	1.20	936.3	94	88	261	58	6.0	4.0
13	120/11:02	256	386	0.52	1.10	1.10	942.5	96	91	262	60		
TOTAL													
AVERAGE													

heated line 250°F

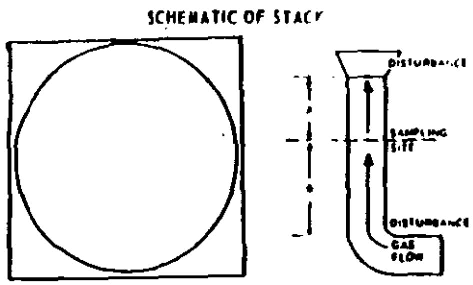
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#2

PARTICULATE FIELD DATA



PLANT Niles, Ohio SNOX

DATE 7-29-93

LOCATION outlet of baghouse

OPERATOR Leonard, Hupp

STACK NO. ______

RUN NO. N-19-HUM-784

SAMPLE BOX NO. 1

METER BOX NO. X-40513

AMBIENT TEMPERATURE 82°

BAROMETRIC PRESSURE 29.14

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 9ft. glass

NOZZLE DIAMETER, in. 0.247

STACK DIAMETER, in. 8ft.

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER $\Delta H_@$ 1.65

C FACTOR 0.98

PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TOP TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	PROBE TEMP °F STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY fps
14	190/11:12	265	386	0.52		1.0	1.0	948.9	99	93	262°F	62	6.0	4.3
15	140/11:22	265	386	0.86		1.86	1.86	955.4	100	95	262	63	7.0	4.2
16	150/11:32	266	385	0.64		1.40	1.40	962.6	104	97	263	65	6.5	4.3
17	160/11:42	266	386	0.72		1.60	1.60	969.6	105	98	264	69	6.8	4.4
18	170/11:52	264	384	0.68		1.45	1.45	976.9	105	98	261	64	6.5	4.4
19	180/12:02	264	383	0.50		1.10	1.10	984.0	105	100	261	61	5.8	4.5
20	190/12:12	261	384	0.70		1.50	1.50	990.3	104	100	261	61	6.3	4.5
21	200/12:22	266	385	0.40		0.86	0.86	997.4	107	102	262	65	5.2	4.9
22	210/12:32	261	383	0.58		1.20	1.20	1003.0	104	101	262	56	6.0	4.7
23	220/12:42	263	383	0.32		0.70	0.70	1009.2	104	101	262	56	5.0	4.7
24	230/12:52	262	382	0.25		0.54	0.54	1014.3	103	101	261	59	4.8	4.5
	240/13:02	NF						1018.698						
SIDE														
1	250/13:12	m		0.18		0.40	0.40	1018.688						
2	260/13:22	252		0.28		0.60	0.60	1023.5	102	100	262	64	4.8	4.6
TOTAL														
AVERAGE														

static pressure 8.5" H_2O

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

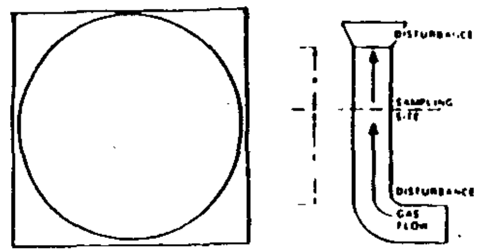
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#3

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process

DATE 7/29/93

LOCATION outlet of baghouse

OPERATOR Lemanl, Hupp

STACK NO

RUN NO N-19-MUM-724

SAMPLE BOX NO. 1

METER BOX NO X-40513

AMBIENT TEMPERATURE 87°F

BAROMETRIC PRESSURE 29.14

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. 9ft. glass

NOZZLE DIAMETER, in. 0.297

STACK DIAMETER, in. 8ft.

PROBE HEATER SETTING 250°F

HEATER BOX SETTING 250°F

METER ΔH@ 1.65

C FACTOR 0.90

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Probe Temp °F ~~STATIC PRESSURE (in. H2O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCITY
3	260/13:32	252	375	0.37	0.80	0.80		103	100	262	63	5.1	4.6
4	270/13:42	252	381	0.48	1.05	1.05		101	97	258	57	5.8	4.6
5	280/13:52	256	384	0.50	1.05	1.06	1038.8	105	101	262	61	6.0	4.7
6	290/14:02	258	379	0.50	1.05	1.05	1044.9	101	98	257	61	6.0	4.8
7	300/14:12	261	382	0.58	1.25	1.25	105	106	100	261	65	6.0	6.0
8	310/14:22	256	382	0.72	1.56	1.65	1057.5	106	103	262	68	6.8	4.5
9	320/14:32	258	383	0.60	1.30	1.30	1064.7	107	102	262	68	6.5	4.4
10	330/14:42	262	384	0.72	1.55	1.55	1071.5	108	103	262	70	6.8	4.6
11	340/14:52	245	383	0.63	1.36	1.35	1078.7	109	104	262	62	6.4	4.6
12	350/15:02	263	383	0.72	1.55	1.65	1085.6	111	105	262	61	6.8	5.0
13	360/15:12	266	383	0.80	1.70	1.70	1092.7	114	108	262	62	7.0	5.0
14	370/15:22	250	383	0.68	1.50	1.50	1100.1	112	107	261	62	6.8	5.0
15	380/15:32	266	384	0.79	1.70	1.70	1107.4	111	107	261	65	7.0	4.8
16	390/15:42	259	385	0.60	1.30	1.30	1114.9	114	109	262	55	6.6	5.0
17	400/15:52	263	384	0.77	1.70	1.70	1121.9	115	110	263	55	7.0	5.3
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

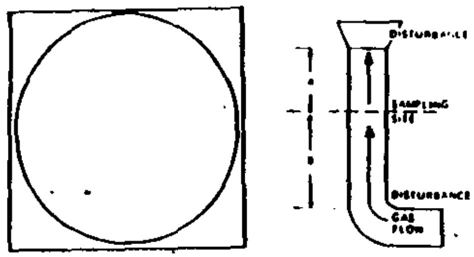
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

#9

PARTICULATE FIELD DATA

SCHEMATIC OF STAC



CROSS SECTION

PLANT Niles, Ohio snoxcover
DATE 7/24/93
LOCATION outlet of bag house
OPERATOR Lemarl, Hupp
STACK NO. ____
RUN NO. N-19-MUM-724
SAMPLE BOX NO. 1
METER BOX NO. 2-40513

AMBIENT TEMPERATURE 88°F
BAROMETRIC PRESSURE 29.14
ASSUMED MOISTURE, % 7
PROBE LENGTH, in. 8ft. glass
NOZZLE DIAMETER, in. 0.247
STACK DIAMETER, in. 8ft.
PROBE HEATER SETTING 250°F
HEATER BOX SETTING 250°F

METER $\Delta H_@$ 1.65
C FACTOR 0.90
PROCESS WEIGHT RATE ____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	probe temp °F ~~STATIC PRESSURE (in. H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET $(T_{m_{in}})$, °F	OUTLET $(T_{m_{out}})$, °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	O_2 % VELOCI…
18	410/16:02	262	384	0.56	1.20	1.20	1129.7	116	110	262	56	6.3	5.4
19	420/16:12	262	384	0.78	1.70	1.70	1136.2	114	110	260	56	7.0	6.5
20	430/16:22	260	384	0.82	1.80	1.80	1144.0	114	110	261	59	7.1	5.2
21	440/16:22	265	382	0.76	1.66	1.65		117	111	261	60	7.1	5.3
22	450/16:42	265	383	0.75	1.65	1.65	1159.0	118	112	262	62	7.1	5.3
23	460/16:52	263	382	0.75	1.66	1.65	1166.4	117	112	261	60	7.1	5.2
24	470/17:02	265	382	0.52	1.15	1.15	1174.0	119	113	262	63	6.0	6.0
	480/17:12	off					1180.563						
TOTAL													
AVERAGE													

leak check after run 0.040 cfm at 10" Hg

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-24-93 (Sat.)	ORIFICE CORRECTION 1.573	HOT BOX NO. 6
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-MUM-724	METER CORRECTION 1.0157	COLD BOX NO. 6
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.441	CALIBRATION DATE 07-02-93	PROBE NO. 13-2
CONTROL BOX OPERATOR KPC	STATIC PRESSURE 16.0" H2O	PITOT CORRECTION 0.84	FILTER NO. [illegible]
BAROMETRIC PRESSURE 29.35	PORT DIRECTION Port #2	CONTROL BOX NO. THREE	STACK DIA. 10'X24'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
110"	09:03	714.650	.10	1.62	1.62	70	70	3.5	639	~250°F	68°F	~250°F	20 min/pt
			.08	1.29	1.21	86	72	3.5	650				
			.08	1.29	1.29	88	73	3.5	628				
			.08	1.29	1.29	92	76	3.5	627				
90"			.09	1.45	1.45	96	78	3.5	628				
			.09	1.45	1.45	96	81	3.5	629				
			.10	1.62	1.62	98	81	3.5	626				
			.10	1.62	1.62	101	83	4.0	628				
70"			.08	1.29	1.29	103	87	4.0	626				
			.08	1.29	1.29	104	87	4.0	620				
			.08	1.29	1.21	104	87	4.0	640				
			.08	1.29	1.29	104	88	4.0	631				
50"			.05	.81	.81	104	89	2.5	629				
			.07	1.13	1.13	104	89	3.0	631				
			.08	1.29	1.29	105	90	3.0	633				Estimates:
			.08	1.29	1.29	104	90	3.0	635				MW=29.2
30"			.10	1.62	1.62	104	91	4.5	637				%H2O= 9
			.09	1.45	1.45	102	91	4.5	631				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	13.0	<0.02 cfm

1st filter

PITOT LEAK CHECK

	Positive	Negative
Before	OK/15sec	OK/15sec
After	OK/15sec	OK/15sec

	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Fyrite check 21% 10:25

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	Empty	710.2	434.3	275.9
2.	150 mL NH4/H2O2	804.3	607.4	196.9
3.	150 mL NH4/H2O2	664.1	633.4	30.7
4.	Empty	464.3	462.3	2.0
5.	100 mL KMnO4	501.1	500.0	1.1
6.	100 mL KMnO4	553.7	558.7	-5.0
7.	Silica Gel	680.0	643.7	42.3

543.9 total

Actual Moisture 8.7

0	0	X	0	0	0
7	6	X	4	2	1

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	BATTELLE / DOE	TEST DATE	07-24-93	ORIFICE CORRECTION	1.572	HOT BOX NO.	6
TEST UNIT	SCR REACTOR OUTLET	TEST NO.	N-20-MUM-724	METER CORRECTION	1.951	COLD BOX NO.	6
PROJECT NO.	93C028-01	NOZZLE (SIZE,#)	0.441	CALIBRATION DATE	07-02-93	PROBE NO.	13-2
CONTROL BOX OPERATOR	RCC	STATIC PRESSURE	16.0" H2O	PITOT CORRECTION	0.84	FILTER NO.	[illegible]
BAROMETRIC PRESSURE	29.35	PORT DIRECTION	Port #2, #3	CONTROL BOX NO.	THREE	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.07	1.13	1.13	105	92	4.0	631	~280°F	~268°F	~300°F	20 min/pt
			.08	1.29	1.27	108	92	4.0	631				
10			.04	.65	.65	109	93	2.0	630				
			.04	.65	.65	106	93	2.0	625				
			.04	.65	.65	106	93	2.0	629				
	11:02	787.581	.04	.65	.65	106	93	2.0	631				
~~110~~													
110'	11:07	787.581	.04	.65	.65	100	94	2.0	631				
			.04	.65	.65	105	94	2.0	635				
			.06	.97	.97	107	95	3.0	647				
			.06	.97	.97	108	95	3.0	651				
90"			.08	1.29	1.29	111	97	5.0	644				
			.08	1.29	1.29	114	98	5.0	652				
			.07	1.13	1.13	114	99	4.5	653				
			.08	1.29	1.29	115	98	5.0	653				Estimates:
70'			.10	1.62	1.62	115	100	6.5	656				MW= 29.2
			.09	1.45	1.45	117	100	6.0	659				%H2O= 9.0
			.10	1.62	1.62	117	101	6.5	651				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	6.0	<0.01 cfm
After	9.0	<0.05 cfm

2nd filter

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	07-24-97	ORIFICE CORRECTION	1.572	HOT BOX NO.	6
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-MUM-724	METER CORRECTION	1.0157	COLD BOX NO.	6
PROJECT NO.	950028-01	NOZZLE (SIZE,ft)	0.441	CALIBRATION DATE	07-02-97	PROBE NO.	13-2
CONTROL BOX OPERATOR	RPC	STATIC PRESSURE	16.0" H2O	PITOT CORRECTION	0.84	FILTER NO.	Unweighed
BAROMETRIC PRESSURE	29.35	PORT DIRECTION	Port 3, 4	CONTROL BOX NO.	Three	STACK DIA.	

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.09	1.45	1.45	118	101	6.0	651	~250°F	<68°F	~300°F	20 min/pt
50'			.05	.81	.81	116	102	4.0	650				
			.06	.97	.97	116	102	4.0	651				
			.06	.97	.97	116	102	4.0	650				
			.06	.97	.97	116	102	4.0	651				
30"			.08	1.29	1.29	117	102	5.0	654				
			.07	1.13	1.13	118	103	5.0	655				
			.07	1.13	1.13	118	103	5.0	656				
			.07	1.13	1.13	117	103	5.0	659				
10'			.05	.81	.81	117	103	4.0	657				
			.05	.81	.81	117	103	4.0	657				
			.05	.81	.81	117	103	4.0	650				
	13:07	857.676	.05	.81	.81	117	103	4.0	649				
110"	13:13	857.676	.08	1.29	1.29	108	104	4.5	649				Estimates:
			.08	1.29	1.29	108	104	5.5	656				MW=29.2
			.08	1.29	1.28	115	103	9.5	660				%H2O=9
			.07	1.13	1.13	114	103	5.0	660				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C048-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.35

TEST DATE 07-24-93
TEST NO. N-20-MM-724
NOZZLE (SIZE,#) 0.441
STATIC PRESSURE 16.0"H2O
PORT DIRECTION Port 4

ORIFICE CORRECTION 1.572
METER CORRECTION 1.0151
CALIBRATION DATE 07-02-93
PITOT CORRECTION 0.84
CONTROL BOX NO. THREE

HOT BOX NO. 6
COLD BOX NO. 6
PROBE NO. 13-2
FILTER NO. Unweighed
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"			[illegible]	1.13	1.13	113	103	16.0	675	~350	68	~300	20min/pt
	13:43	874.530	.08	1.29	1.29	113	103	18.0	680				
	1358	874.600	.07	1.13	1.13	112	102	2.0	681				Changed filter
			.07	1.13	1.13	112	103	2.0	680				at 13:45
80"			.08	1.29	1.29	116	103	3.0	681				
			.09	1.45	1.45	118	103	3.5	682				
			.09	1.45	1.45	119	103	3.5	682				
			.09	1.45	1.45	119	104	3.5	683				
50			.09	1.45	1.45	120	104	3.5	683				
			.09	1.45	1.45	120	104	3.5	683				
			.09	1.45	1.45	120	104	3.5	683				
			.09	1.45	1.45	121	105	4.0	683				
30			.10	1.62	1.62	121	105	5.0	682				
			.10	1.62	1.62	123	105	5.0	686				
			.10	1.62	1.62	123	106	5.0	684				Estimates:
			.10	1.62	1.62	123	106	6.0	685				MW=29.2
10"			.04	.65	.65	120	107	2.0	688				%H2O= 9
			.04	.65	.65	120	106	3.0	682				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 07-24-93	ORIFICE CORRECTION 1.572	HOT BOX NO. 6
TEST UNIT SCR Reactor outlet	TEST NO. N-20-MUM-724	METER CORRECTION 1.0151	COLD BOX NO. 6
PROJECT NO. 7366-28-01	NOZZLE (SIZE,Ø) 0.441	CALIBRATION DATE 07-02-93	PROBE NO. 13-2
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 16.0"H2O	PITOT CORRECTION 0.84	FILTER NO. [illegible]
BAROMETRIC PRESSURE 29.35	PORT DIRECTION Port #6	CONTROL BOX NO. THREE	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.04	.65	.68	100	107	2.0	656	~250F	265°F	~300°F	20 min
	5:28	930120	.04	.65	.65	118	107	2.0	655				
110"	15:36	930.120	.04	.65	.65	109	107	2.0	692				
			.04	.65	.68	110	109	2.0	691				
			.08	1.29	1.29	118	106	3.0	690				
			.09	1.45	1.45	121	106	3.0	691				
90"			.10	1.62	1.62	122	107	4.0	694				
			.10	1.62	1.62	122	107	4.0	695				
			.08	1.29	1.29	123	106	4.0	697				
			.09	1.45	1.45	124	107	4.0	696				
70"			.10	1.62	1.62	125	108	5.0	696				
			.08	1.29	1.29	125	109	4.5	697				
			.09	1.45	1.45	125	109	4.5	699				
			.08	1.29	1.29	125	109	4.0	699				Estimates:
50"			.09	1.45	1.45	124	109	4.5	701				MW= 29.2
			.10	1.62	1.62	124	109	4.5	701				%H2O= 9.0
			.10	1.62	1.62	126	110	5.0	701				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle /ME.	TEST DATE 07-24-93	ORIFICE CORRECTION 1.572	HOT BOX NO. 6
TEST UNIT SCR Reactor outlet	TEST NO. N-20-MUM-724	METER CORRECTION 1.0151	COLD BOX NO. 6
PROJECT NO. 93C328-01	NOZZLE (SIZE,#) 0.441	CALIBRATION DATE 07-02-93	PROBE NO. 13-2
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 16.0 "H2O	PITOT CORRECTION 0.84	FILTER NO. Unaxigns
BAROMETRIC PRESSURE 29.35	PORT DIRECTION Duct	CONTROL BOX NO. THREE	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			.09	1.45	1.45	127	109	6.0	702	~250	48	~300	20 min/PT
30"			.10	1.62	1.62	126	110	5.5	702				
			.08	1.29	1.29	127	110	4.5	701				
			.08	1.29	1.29	125	110	4.5	701				
			.07	1.13	1.13	125	110	4.0	702				
10"			.04	.65	.65	124	110	3.0	702				
			.04	.65	.65	123	116	3.0	701				
			.04	.65	.65	122	110	3.0	690				
	17:36	1006.111	.04	.65	.65	123	110	3.0	697				
	Δ = 8hr	Δ=291.391	(ΔP)avg =	(ΔH)avg =		(Tmeter)avg = 117°F			(Tstack)avg = 669°F				
	=480	dcf			1.20								
	min		0.07						velocity = 21.3 ft/sec				
													Estimates:
									ISO = 95.5%				MW= 29.2
													%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

r-c 1 of 4

STACK SAMPL IG DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-24-93 (Sat.)	ORIFICE CORRECTION 1.802	HOT BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-724	METER CORRECTION 0.9619	COLD BOX NO.
PROJECT NO. 93C428-01	NOZZLE (SIZE,#) 0.197 G18	CALIBRATION DATE 5-19-93	PROBE NO. 10-4
CONTROL BOX OPERATOR JJS	STATIC PRESSURE 0.8" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION A	CONTROL BOX NO. 7	STACK DIA. 58" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	0900	462.224	0.75	0.87	0.87	76	61	5.5	195	~250°F	<68°F	~250°F	(18 min/point
			0.75	0.87	0.87	92	70	5.0	195				
39.3	0918		0.75	0.88	0.88	100	74	5.0	196				Readings every
			0.75	0.89	0.89	106	78	5.0	195				9 min)
32.1	0936		0.90	1.06	1.06	108	80	6.0	197				
			0.90	1.06	1.06	108	80	6.0	196				
25.0	0957		1.05	1.25	1.25	110	82	7.0	197				
			1.05	1.25	1.25	110	82	7.0	196				
17.9	1016		1.05	1.25	1.25	112	84	7.0	198				
			1.05	1.25	1.25	112	84	7.0	199				
10.7	1035		1.20	1.43	1.43	112	84	8.0	199				
			1.20	1.43	1.43	113	85	8.0	200				
3.6	1045		1.15	1.37	1.37	114	86	8.0	202				
	1106	543.463	1.15	1.37	1.37	115	87	8.0	204				
													Estimates:
	Δ=126 min	Δ=81.239 dcf	$(\Delta P)_{AVG}$ = 0.95	$(\Delta H)_{AVG}$ = 1.16		$(T_{meter})_{AVG}$ = 93°F			$(T_{stack})_{AVG}$ = 198°F				MW = 29.2
													%H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	0.020
After	8.0	0.020

PITOT LEAK CHECK 15 sec

POS.	NEG.
OK	OK

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

velocity = 61.3 ft/sec

Iso. = 103.7%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	Empty	719.1	455.0	264.1
2.	150 ml HNO3/H2O2	718.4	537.3	181.1
3.	150 ml HNO3/H2O2	597.0	560.6	36.4
4.	Empty	473.5	468.1	5.4
5.	100 ml KMnO4	548.5	550.4	-1.9
6.	100 ml KMnO4	552.8	556.7	-3.9
7.	Silica Gel	716.6	670.3	46.3

Actual Moisture = 8.0%

527.59 total

KEYSTONE

STACK SAMPI G DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-24-93 (Sat.)	ORIFICE CORRECTION 1.802	HOT BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-724	METER CORRECTION 0.9619	COLD BOX NO.
PROJECT NO. 936-028-01	NOZZLE (SIZE,#) 0.197 G18	CALIBRATION DATE 5-19-93	PROBE NO. 10-4
CONTROL BOX OPERATOR TB	STATIC PRESSURE 0.8" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION B	CONTROL BOX NO. 7	STACK DIA 30" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1115	543.650	0.80	0.94	0.94	106	90	5.5	205	~250°F	68°F	~250°F	18 min/point
			0.80	0.94	0.94	116	90	5.5	206				
39.3	1133		0.95	1.14	1.14	120	92	7.0	206				Readings every 9 min
			0.95	1.14	1.14	120	92	7.0	208				
32.1	1151		0.95	1.14	1.14	121	94	7.0	207				
			0.95	1.14	1.14	122	95	7.0	215				
25.0	1209		0.95	1.14	1.14	122	95	7.0	213				
			0.95	1.14	1.14	122	95	7.0	207				
17.9	1227		0.90	1.08	1.08	124	96	6.5	200				
			0.85	1.03	1.03	124	96	6.5	205				
10.7	1245		0.50	0.61	0.61	124	97	4.0	203				
			0.60	0.73	0.73	124	97	5.0	203				
3.6	[illegible]		0.40	0.49	0.49	124	97	4.0	201				
	1321	618.327	0.50	0.61	0.61	122	96	4.0	201				
													Estimates:
	Δ=126 min	Δ=74.677 dcf	$(\Delta P)_{avg}$ = 0.80	$(\Delta H)_{avg}$	= 0.95	$(T_{meter})_{avg}$	= 108°F		$(T_{stack})_{avg}$	= 204°F			MW = 29.2 %H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After	8.0	0.010

PITOT LEAK CHECK

POS.	NEG.

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

velocity = 56.5 ft/sec

Iso. = 101.6%

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

Page 2 of 4

STACK SAMF NG DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-21/93 (Sat)	ORIFICE CORRECTION 1.002	HOT BOX NO. 5
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-MUM-724	METER CORRECTION 0.9617	COLD BOX NO.
PROJECT NO. 93C 6128-01	NOZZLE (SIZE,in) 0.177 8/8	CALIBRATION DATE 5-19-93	PROBE NO. 10-4
CONTROL BOX OPERATOR JTS	STATIC PRESSURE 0.8" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION D	CONTROL BOX NO. 7	STACK DIA 58" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1548	708.912	0.70	0.84	0.84	116	99	5.0	197	~250°F	<68°F	~250°F	18 min/point
			0.65	0.79	0.79	124	98	5.0	199				
39.3	1606		0.60	0.73	0.73	127	100	4.5	198				Readings every 9 min
			0.60	0.73	0.73	127	100	4.5	199				
32.1	1624		0.65	0.80	0.80	129	101	5.0	196				
			0.75	0.92	0.92	130	102	5.5	196				
25.0	1642		0.95	1.17	1.17	131	104	6.5	198				
			0.95	1.17	1.17	132	105	6.5	198				
17.9	1700		1.00	1.24	1.24	133	106	7.0	198				
			1.00	1.24	1.24	133	105	7.0	200				
10.7	1718		1.15	1.42	1.42	132	105	8.0	199				
			1.15	1.42	1.42	131	104	8.0	200				
3.6	1736		1.05	1.30	1.30	130	103	7.0	201				
	1754	788.803	1.10	1.36	1.36	128	102	7.5	195				
													Estimates:
	Δ=126 min	Δ=79.891 dcf	$(\Delta P)_{avg}$ = 0.85	$(\Delta H)_{avg}$ = 1.08		$(T_{meter})_{avg}$ = 116°F			$(T_{stack})_{avg}$ =		199°F		MW=29.2 %H2O=8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After	9.0	0.015

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

velocity = 58.0 ft/sec

Iso. = 103.7%

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-24-93 (Sat.)	ORIFICE CORRECTION	1.802	HOT BOX NO.	5
TEST UNIT	SNOX Tower Outlet	TEST NO.	N-21-MUM-724	METER CORRECTION	0.9619	COLD BOX NO.	
PROJECT NO.	93C028-01	NOZZLE (SIZE, ft)	0.197 G18	CALIBRATION DATE	5-19-93	PROBE NO.	10-4
CONTROL BOX OPERATOR	TPS	STATIC PRESSURE	0.8" H2O	PITOT CORRECTION	0.84	FILTER NO.	
BAROMETRIC PRESSURE	29.35	PORT DIRECTION	C	CONTROL BOX NO.	7	STACK DIA.	50" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
46.4	1332	618.490	0.90	1.09	1.09	108	97	6.0	201	~250°F	48°F	~220°F	18 min/point
			0.90	1.09	1.09	121	96	6.0	201				
39.3	1350		0.95	1.16	1.16	122	96	6.5	202				Readings every
			0.95	1.16	1.16	123	96	6.5	201				9 minutes
32.1	1408		1.30	1.58	1.58	124	97	8.5	201				
			1.30	1.58	1.58	125	98	8.5	198				
25.0	1426		1.35	1.64	1.64	125	98	9.0	198				
			1.35	1.64	1.64	126	100	9.0	198				
17.9	1444		1.30	1.60	1.60	126	100	9.0	197				
			1.35	1.66	1.66	128	100	9.0	197				
10.7	1502		1.30	1.60	1.60	127	100	9.0	197				
			1.20	1.47	1.47	126	100	8.0	198				
3.6	1520		0.95	1.17	1.17	126	100	7.0	198				
	1538	708.739	0.90	1.10	1.10	126	100	6.5	198				
													Estimates:
	Δ = 126 min	Δ = 90.249 dcf	$(\Delta P)_{avg}$ = 1.15	$(\Delta H)_{avg}$ = 1.40		$(T_{meter})_{avg}$ = 111°F			$(T_{stack})_{avg}$ = 199°F				MW = 29.2 %H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After	9.0	0.020

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

velocity = 67.5 ft/sec

Iso. = 101.6%

KEYSTONE

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle /OE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 2.002	HOT/COLD BOX NO. 3
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-FCL-719	METER CORRECTION (Y) 0.9812	PROBE NO. 13-2
PROJECT NO. 93C029-01	NOZZLE (SIZE, in) 0.440"	CALIBRATION DATE 06-09-93	FILTER NO. —
TEST CREW KPC	STATIC PRESSURE +17.0" H2O	PITOT CORRECTION 0.84	STACK DIA.
BAROMETRIC PRESSURE 29.60	PORT DIRECTION Port #6	CONTROL BOX NO. 5.1	PORT SIZE 36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
90'	13:41	43.456	.10	1.99	1.99	85	82	2.0	680	~250°F	<68°F	~250°F	90 min./point
			.10	1.99	1.99	98	83	2.0	681				Single Point
			.10	1.99	1.99	99	83	2.0	679				Isokinetic
			.10	1.99	1.99	105	85	3.5	681				Sampling for
			.05	1.00	1.00	110	90	4.5	679				1.5 Hours
			.05	1.00	1.00	107	91	4.5	680				
			.05	1.00	1.00	108	94	5.5	681				Readings every
			.05	1.00	1.00	112	95	5.5	680				[illegible] minutes
			.06	1.19	1.19	114	94	5.5	671				
			.05	1.00	1.00	114	95	5.5	680				
			.05	1.00	1.00	114	95	6.0	659				
			.05	1.00	1.00	115	97	6.5	658				
			.05	1.00	1.00	115	98	6.5	659				
			.05	1.00	1.00	117	99	7.0	660				
			.05	1.00	1.00	116	99	7.0	656				
			.05	1.00	1.00	115	99	7.0	656				Estimates:
			.05	1.00	1.00	115	100	7.0	664				MW= 29.2
15:11	~~[illegible]~~	100.400	.05	1.00	1.00	117	100	7.5	660				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01cfm
After	9.0	<0.02cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	13.0
O2	6.0	6.0
CO	0	0
N2	81.0	81.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50mL D.I. H2O	611.6	538.8	72.8
2.	100mL CO3^2-/HCO3-	577.0	553.1	23.9
3.	100mL CO3^2-/HCO3-	467.7	463.8	3.9
4.	200g Silica Gel	679.0	664.0	15.0
5.				

115.6g total
AQE 6/93
Actual Moisture = 9.6%

TIME = 90 min
VOLUME = 56.944 dcf
$(\Delta P)_{avg}$ = 0.06

$T_{stack,avg}$ = 669°F
[illegible]

velocity = 19.9 ft/sec
Iso. = 105.3%

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 1.808	HOT/COLD BOX NO. 1
TEST UNIT SWUX Tower Outlet	TEST NO. N-21-FCL-719	METER CORRECTION (Y) 0.9619	PROBE NO. 7-2
PROJECT NO. 93C028-01	NOZZLE (SIZE) 0.195" #617	CALIBRATION DATE 5-17-93	FILTER NO.
TEST CREW TM-J3	STATIC PRESSURE 0.1" H2O	PITOT CORRECTION 0.84	STACK DIA. 50" (depth) x
BAROMETRIC PRESSURE 29.10	PORT DIRECTION D	CONTROL BOX NO. 7	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
50"	7:30	662.800	1.05	1.17	1.17	87	82	5.0	198	~250F	<68°F	~250°F	90 min./point
	"		1.15	1.29	1.29	102	82	5.5	198				Single Point
	"		1.15	1.29	1.29	115	84	5.5	198				Isokinetic
	"		1.15	1.29	1.29	117	85	5.5	198				Sampling for
	"		1.10	1.26	1.26	117	85	5.0	198				1.5 Hours
	"		1.08	1.23	1.23	118	85	6.5	198				
	"		1.07	1.23	1.23	118	85	6.0	198				Readings every
	"		1.10	1.26	1.26	118	85	7.0	198				10 minutes
	"		1.10	1.26	1.26	118	85	7.0	198				
	10:00	723.310	1.10	1.26	1.26	118	85	7.0	198				
	Δ =												
	90 min	Δ = 60.510 dcf	$(\Delta P)_{avg}$ = 1.10	$(\Delta H)_{avg}$ = 1.25		$(T_{meter})_{avg}$ = 99°F			$(T_{stack})_{avg}$ = 198°F				
						velocity = 66.3 ft/sec							Estimates:
						Iso. = 101.2%							MW = 29.2
													%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.007
After	7.0	0.010

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	ok	ok
After	ok	ok

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents H_2O_2/SO_3^{2-}	Final	Initial	Difference
1.	100 mL [illegible]	687.9	545.9	42.0
2.	100 mL SO_3^{2-}/H_2O_2	578.3	566.6	11.7
Empty 3.	~~100 mL SO_3^{2-}/H_2O_2~~	436.0	433.3	2.3
4.	200g Silica Gel	658.6	646.3	12.3
5.				

Total = 118.3g

AQE 6/92

Actual Moisture = 9.

N-18- FCL - 722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] SOURCE SAMPLING DATA SHEET

Page of

CLIENT DOE
TEST UNIT Rushouse SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/22/93
TEST NO. N-18- FCL - 722
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Stack Reading~~ Flow Rate (cuft/min) ~~(cc/min)~~	~~Rotameter~~ Reading Orifice Mano (in H2O)	Meter ~~Avg Exit~~ Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Temp. Filter Inlet (°F)	Comments
Start	19:35	908.100									
	19:37		.675	1.5	80	2	366	248	59	179	
	19:45	915.105	.75	1.9	84	2.5	366	259	58	221	
	19:55	922.492	.725	1.8	85	3.0	366	247	61	248	
	20:05	929.648	.71	1.7	85	3.5	367	250	60	255	
	20:20	940.085	.68	1.6	85	4.5	367	251	59	249	
	20:35	950.705	.69	1.6	86	6.0	366	255	59	249	
	20:50	961.189	.70	1.7	86	7.0	368	254	59	238	
End	20:56	964.848									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate ~~(cc/min)~~ cuft/min
Before	15	.005
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

N-19 FCL

N-19-FCl-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

Page of

CLIENT ______
TEST UNIT ______
PROJECT NO. ______
SYSTEM OPERATOR Kevin Rose
BAROMETRIC PRESSURE ______

TEST DATE 7/22/92
TEST NO. N-19-FCl-722
SITE NO. 19
STACK DIAMETER ______
PORT DIRECTION ______

DRY GAS METER NO. ______
METER CORRECTION (Y) ______
CALIBRATION DATE ______

~~Traverse Point~~ (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Buck Reading (cc/min)~~ Sample Line Hg	Pitot Tube Hg	~~Rotameter Reading~~ Sampling Line Temp °F	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
0	1008	7084	~~0072~~	0.72	2	70	0	380	206	68	356	
Start	1010	7081	2.0	0.72		70	12	380	206	68	356	
10 min	1020	716.3	2.2	0.72	249	73	12	386	229	65	247	
20 min	1031	725.5	2.2	0.69	248	74	20.3	380	259	71	226	
30 min	1040	~~[illegible]~~	2.2	0.76	248	76	20.3	379	~~256~~ 254	75	220	
40 min	1050	740.6	2.2	0.67	249	78	19	380	266	75	261	
50 min	1100	749.9	2.8	0.70	249	79	19.5	379	243	71	248	
60 min	1110	759.2	2.8	0.67	251	79	19.6	380	233	73	251	
Stop	1117	760.6										
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

760.9 = 52.5 cuft.

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028 - 01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thurs.)
TEST NO. N-20-FCL-722
NOZZLE (SIZE, in) 0.485
STATIC PRESSURE 17.0" H_2O
PORT DIRECTION Port 6

ORIFICE CORRECTION 2.002
METER CORRECTION 0.9812
CALIBRATION DATE 06-09-93
PITOT CORRECTION 0.84
CONTROL BOX NO. six

HOT BOX NO. 3
COLD BOX NO. 5
PROBE NO. 13-1
FILTER NO. unused
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	10:44	285.900	.05	1.45	1.45	85	85	3.0	633	~250°F	<68°F	~250°F	Single Point
			.05	1.45	1.45	94	82	3.0	632				Isokinetic
			.05	1.45	1.45	100	85	3.0	635				Sampling for
			.05	1.45	1.45	109	87	3.0	645				1.5 Hours
			.06	1.74	1.74	115	91	3.5	645				
			.06	1.74	1.74	116	93	4.0	642				Readings every
			.06	1.74	1.74	119	94	4.0	653				10 minutes
			.06	1.74	1.74	117	95	4.0	655				
	12:14	350.240	.06	1.74	1.74	119	95	4.0	651				
	Δ=90 min	Δ=64.340 dcf	$(\Delta P)_{Avg}$ = 0.06	$(\Delta H)_{Avg}$ = 1.61		$(T_{meter})_{Avg}$ = 99°F			$(T_{stack})_{Avg}$ = 643°F				

Velocity = 19.5 ft/sec

ISO = 96.9%

Estimates:
MW = 29.2
%H2O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.015 cfm
After	5.0	<0.001 cfm

PITOT LEAK CHECK

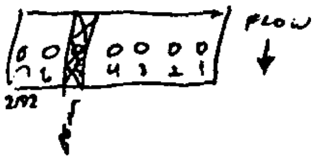
	Positive	Negative
Before	OK/15 sec	OK/15 sec
After		

	1	2
CO2	14.0	14.0
O2	6.0	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml 1N HNO_3	616.6	539.3	77.3
2.	100 ml Hex/H_2O_2	569.0	550.6	18.4
DRY 3.	~~Hex/H_2O_2~~	467.7	464.9	2.8
4.	200 g Silica Gel	681.6	667.9	13.7
5.				

112.2 g total

Actual Moisture 8.3



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STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93X020-01
CONTROL BOX OPERATOR TM
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93
TEST NO. N-21-FCL-722
NOZZLE (SIZE,#) 0.175 #17
STATIC PRESSURE 0.15" H2O
PORT DIRECTION D

ORIFICE CORRECTION 1.802
METER CORRECTION 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 7

HOT BOX NO. 1
COLD BOX NO. 1
PROBE NO. 72
FILTER NO.
STACK DIA. 50" (depth) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	11:00	918.658	1.05	1.20	1.20	90	84	5.5	200	~250°F	68°F	~250°F	Single Point
			1.05	1.20	1.20	104	83	5.5	200				Isokinetic
			1.05	1.20	1.20	111	86	5.5	200				Sampling for
			1.05	1.20	1.20	111	86	5.5	200				1.5 Hours
			1.05	1.20	1.20	118	85	5.0	200				
			1.05	1.20	1.20	118	85	5.0	200				Readings every
	12:00		1.05	1.20	1.20	118	85	5.0	200				10 minutes
			1.05	1.20	1.20	118	85	4.5	200				
			1.05	1.20	1.20	118	85	4.5	200				
	12:30	979.380											
	Δ=90 min	Δ=60.722 dcf	$(\Delta P)_{avg}$ = 1.05	$(\Delta H)_{avg}$ = 1.20		$(T_{meter})_{avg}$ = 98°F			$(T_{stack})_{avg}$ = 200°F				
								Velocity = 64.4 ft/sec					Estimates:
													MW= 29.2
								Iso = 105.6%					%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.002
After	5.5	0.003

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	ok	ok
After	ok	ok

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

MW = 29.3

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml CO_3/HCO_3	615.7	547.0	68.7
2.	100mL HCO_3/CO_3	581.9	563.4	18.5
3.	Dry	438.2	434.4	3.8
4.	200g Silica Gel	675.1	659.4	15.7
5.				

106.7 g total

Actual Moisture = 8.5%

KEYSTONE

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
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[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Baghouse Inlet
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/29/93
TEST NO. N-18-FCL-729
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Flow Rate ~~Back~~ Reading (ft^3/min)	~~Rotameter~~ Reading Orifice manometer	Meter ~~Inlet~~ Avg. Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Filter Inlet Temp. (°F)	Comments
	10:30	971.100	.665	1.5	81	2.5	365	250	59	186	
	10:35	974.237	.66	1.6	83	3.0	366	257	55	212	
	10:45	980.949	.675	1.6	87	3.5	366	260	54	253	
	11:00	991.584	.68	1.7	89	5.0	365	245	56	260	
	11:15	1001.735	.72	1.8	91	7.0	364	247	55	252	
	11:30	1011.986	.65	1.5	93	8.0	366	261	57	251	
	11:45	1022.008	.645	1.5	94	9.0	367	251	60	247	
	End	1027.301									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate ~~(cc/min)~~ (cuft/min)
Before	15	.002
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO_2		
O_2		
CO		
N_2		

AQE 7/92

971
55
1026

N49-~~ACO~~ FCL-724

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
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[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT ____
TEST UNIT ____
PROJECT NO. ____
SYSTEM OPERATOR J. Kevin Rose
BAROMETRIC PRESSURE ____

TEST DATE 7/24/93
TEST NO. N-19-FCl-724
SITE NO. 19
STACK DIAMETER ____
PORT DIRECTION ____

DRY GAS METER NO. ____
METER CORRECTION (Y) ____
CALIBRATION DATE ____

Traverse ~~Point~~ (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Back~~ Sample Reading (in H_2O) ~~(cc/min)~~	Pitot Tube (in H_2O)	~~Rotameter Reading~~ Sample Line Temp (°F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger 3 Temp. (°F)	Probe Temp. (°F)	Comments
	0903	795.595	0	0.74	254	70	0	382	267	68	352	0
	0914	795.545	2.2	0.75	252	69	~~2.0~~ 5.0	381	252	69	347	START
	0926											Test Run
	0928	—	2.2	0.75	249	73	5.0	381	229	63	254	Restart
	0939	813.8	2.2	0.75	256	76	5.0	382	257	65	253	
	0949	821.5	2.15	0.74	215	78	5.0	382	266	67	266	
	0959	829.7	2.15	0.75	271	79	5.0	381	269	64	256	Increased to 2.3 in H_2O
	1015	844.1	2.3	0.73	275	82	5.0	381	272	63	264	
	1022	848.6	2.3	0.72	273	82	5.0	381	272	66	265	
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	59cc/.002 cu ft.
After	15	58cc/.002cu ft

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

Total = 52.5 cu ft
848.1

AQE 7/92

STACK SAMPLING DATA SHEET

CLIENT BATTELLE / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C924-61
CONTROL BOX OPERATOR RLC
BAROMETRIC PRESSURE 29.35

TEST DATE 07-24-93
TEST NO. N-20-FCL-724
NOZZLE (SIZE,#) 0.485
STATIC PRESSURE No 0" H_2O
PORT DIRECTION Port #6

ORIFICE CORRECTION 1.883
METER CORRECTION 1.0338
CALIBRATION DATE 07-16-93
PITOT CORRECTION 0.84
CONTROL BOX NO. ONE

HOT BOX NO. 5
COLD BOX NO. 5
PROBE NO. 13-1
FILTER NO. Unweighed
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	10:00	659.200	.05	1.37	1.37	68	67	3.5	639	~250°	<68°	~250°	Single Point
			.05	1.37	1.37	82	69	4.0	640				Isokinetic
			.06	1.64	1.64	87	72	5.0	640				Sampling for
			.06	1.64	1.64	93	76	5.0	640				1.5 hours
			.06	1.64	1.64	95	77	5.0	639				
			.06	1.64	1.64	96	79	5.0	637				Readings
			.06	1.64	1.64	98	80	5.0	621				every 10 min
			.06	1.64	1.69	100	83	5.0	639				
	11:30	720.371	.06	1.64	1.64	102	85	5.0	655				
	Δ=90 min	Δ=61.171 dcf	$(\Delta P)_{avg}$= 0.06	$(\Delta H)_{avg}$ = 1.58		$(T_{meter})_{avg}$ = 84°F		$(T_{stack})_{avg}$ = 641°F					

velocity = 19.5 ft/sec

ISO. = [illegible] 100.5 %

Estimates:
MW= 29.2
%H2O= 9.0

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

FLOW

AQE 2/92

PITOT LEAK CHECK

	Positive	Negative
Before	ok/15sec	ok/15sec
After	ok/15sec	ok/15sec

	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

FINAL CHECK 2118 @ 1025

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100mL HCO_3^-/CO_3^{2-}	621.0	540.1	80.9
2.	100mL HCO_3^-/CO_3^{2-}	572.4	552.9	19.5
3.	Empty	467.3	464.8	2.5
4.	Silica Gel	682.4	667.5	14.9
5.				

Actual Moisture 8.4%

117.8g total

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STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-24-93 (Sat.)	ORIFICE CORRECTION	1.673
TEST UNIT	SNOX Tower Outlet	TEST NO.	N-21-FCL-724	METER CORRECTION	0.9912
PROJECT NO.	93C0822-D	NOZZLE (SIZE, ID)	0.195 @17	CALIBRATION DATE	5-19-93
CONTROL BOX OPERATOR	MI	STATIC PRESSURE	0.5" H2O	PITOT CORRECTION	0.84
BAROMETRIC PRESSURE	29.35	PORT DIRECTION	↓	CONTROL BOX NO.	4

HOT BOX NO. 1
COLD BOX NO. 1
PROBE NO. 7-2
FILTER NO.
STACK DIA. 50" (inlet) × 99" (outlet)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	9:30	481.430	1.0	1.07	1.07	108	90	4.0	195	~250°F	<68°F	~250°F	Sample Point
			1.0	1.07	1.07	110	90	5.0	195				Isokinetic
			1.0	1.07	1.07	112	91	5.0	196				Sampling for
	10:00		1.0	1.07	1.07	114	92	5.0	197				1.5 hrs
			1.0	1.07	1.07	115	92	5.0	197				
			1.0	1.07	1.07	115	94	5.0	198				Reading every
	10:30		1.0	1.07	1.07	115	94	5.0	198				10 min
			1.0	1.07	1.07	116	95	5.0	198				
			1.0	1.07	1.07	116	95	5.0	198				
	11:00	533.330											
	Δ=90 min	Δ=51.900 dcf	$(\Delta P)_{avg}$ = 1.0	$(\Delta H)_{avg}$ =	1.07	$(T_{meter})_{avg}$ = 103°F		$(T_{stack})_{avg}$ = 197°F					
						velocity = 62.8 ft/sec							Estimates:
						Iso. = 93.5%							MW=29.2
													%H2O=8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	0.004
After	5.0	0.006

PITOT LEAK CHECK 15 sec

POS.	NEG.
ok	ok

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml H2O2/SO2	603.2	545.2	58.0
2.	100ml H2O2/H2O2	582.0	566.2	15.8
3.	Empty	437.0	434.6	2.4
4.	Silica Gel	663.5	651.8	11.7
5.				

87.9 g total

Actual Moisture = 8.1%

KEYSTONE

D-4: Ammonia Train

FIELD DATA

PLANT Niles
DATE 7/19/93
SAMPLING LOCATION Baghouse Inlet 1B
SAMPLE TYPE
RUN NUMBER
OPERATOR Kent Rennie
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

~~N-18-NH4~~
~~N-18-NH4-719~~
N-18-NH4-719

PROBE LENGTH AND TYPE SS 4 ft
NOZZLE I.D. .2424
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ______ MINUTES

~~TRAVERSE POINT NUMBER~~ Clock time	SAMPLING TIME, min / CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE ~~INLET~~ Avg ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE ~~OUTLET~~ ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	Probe Temp °F
12:00	0	817.700	.8	1.7		~~[illegible]~~						
12:01	≈1		"	1.7	1.7	362	87		2	255	67	191
12:05	≈5 Flowrate	.72 ft³/min	"	1.7								
12:10	≈10	825.459	"	1.7	1.7	365	98		3	267	61	241
12:11	≈11 Flowrate	.71 ft³/min										
12:15	end	829.398										

COMMENTS:

EPA (Dur) 235

N-19-NH4-719

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE / PETC
TEST UNIT
PROJECT NO. 62925
SYSTEM OPERATOR DL Smith
BAROMETRIC PRESSURE

TEST DATE 7/19/93
TEST NO. NH3
SITE NO. 19
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO. 2
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Buck~~ Reading Flow rate (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp / Heated Line (°F)	Comments
	1255	672.395									
	1300	676.7			83	6	381	200	68	179/267	
	1305	680.2			83	6	381	217	67	180/265	
	1310	684.332			83	6	381	229	67	176/263	
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate cu ft/min
Before	15	.02
After	6	.02

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 7/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@)	2.002	HOT/COLD BOX NO.	1
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20 NH4-719	METER CORRECTION (Y)	0.9812	PROBE NO.	13-3
PROJECT NO.	93C028-41	NOZZLE (SIZE,#)	0.441"	CALIBRATION DATE	06-09-93	FILTER NO.	
TEST CREW	RPC	STATIC PRESSURE	17.0" H_2O	PITOT CORRECTION	0.84	STACK DIA.	
BAROMETRIC PRESSURE	29.70	PORT DIRECTION	Port #6	CONTROL BOX NO.	5.X	PORT SIZE	36"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
90"	15:36	101.115	.06	1.19	1.19	95	97	1.0	656	~250°F	<68°F	~250°F	30 min./point
			.06	1.19	1.19	109	95	1.0	644				Single Point
			.06	1.19	1.19	112	95	1.0	661				Isokinetic
			.06	1.19	1.19	114	95	1.5	657				Sampling for
			.07	1.39	1.39	116	97	2.0	655				30 minutes
	16:06	120.710	.07	1.39	1.39	116	97	2.0	657				
													Readings every
	Δ = 30 min	Δ = 19.595 dcf	$(\Delta P)_{avg}$ = 0.06	$(\Delta H)_{avg}$ = 1.26		$(T_{meter})_{avg}$ = 103°F			$(T_{stack})_{avg}$ = 655°F				5 minutes
								velocity = 19.7 ft/sec					
								Iso = 110.3%					
													Estimates:
													MW = 29.2
													%H2O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.0	<0.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL D.I. H_2O	~~515.2~~	~~484.6~~	
2.	100 mL 0.1N H_2SO_4	~~566.3~~	~~560.6~~	
3.	100 mL 0.1N H_2SO_4	~~395.7~~	~~394.9~~	
4.	200g Silica Gel	~~660.2~~	~~660.9~~	
5.				

M.B.B. Actual numbers.

49.9 total

1.) 50mL DI H_2O 559.0 525.1 33.9
2.) 100ml 0.1N H_2SO_4 579.5 - 571.2 8.3
3.) 100ml 0.1N H_2SO_4 381.7 - 380.5 1.2
4.) 200g Silica gel 636.5 630.0 6.5

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE	TEST DATE 8-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 1.802	HOT/COLD BOX NO. 7
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-NH4-719	METER CORRECTION (Y) 0.9615	PROBE NO. 7-8
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.195" 617	CALIBRATION DATE 5-12-93	FILTER NO.
TEST CREW TM JS	STATIC PRESSURE 10" H2O	PITOT CORRECTION 0.84	STACK DIA. 50" (depth) x
BAROMETRIC PRESSURE 29.10	PORT DIRECTION D	CONTROL BOX NO. 7	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
50"	11:20	723.510	1.07	1.23	1.23	102	84	4.0	198	~250°F	48°F	~250°F	30 min./point
	5		1.07	1.23	1.23	110	84	4.0	197				Single Point
	•		1.07	1.23	1.23	115	85	4.0	199				Isokinetic
	5		1.07	1.23	1.23	116	85	4.0	198				Sampling for
	•		1.07	1.23	1.23	110	85	4.0	197				30 minutes
	5		1.07	1.23	1.23	117	85	4.0	198				
	11:50	744.250	1.07	1.23	1.23	116	85	4.0	198				Readings every
													5 minutes
	Δ=30	Δ=20.740	$(\Delta P)_{avg}$ =	$(\Delta H)_{avg}$	=1.23	$(T_{meter})_{avg}$	= 99°F		$(T_{stack})_{avg}$	= 198°F			
	min	dcf											
			1.07										
						velocity	= 65.4 ft/sec						
						Iso.	= 106.8%						
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	5.0	0.007

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	ok	ok
After	ok	ok

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents 0.1 N H2SO4	Final	Initial	Difference
1.	100 mL ~~[illegible]~~	515.2	484.6	30.6
2.	100 mL 0.1 N H2SO4	566.3	560.6	5.7
3. Empty	~~[illegible]~~	395.7	394.9	0.8
4.	200 g Silica Gel	666.2	660.9	5.3
5.				

42.4 g total

Actual Moisture = 9.8%

AQE 6/92

29 "

N-18-NH4-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 26~~ SOURCE SAMPLING DATA SHEET

Page of

CLIENT DOE
TEST UNIT Baghouse SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/22/93
TEST NO. N-18-NH4-722
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point ~~(inches)~~	Clock Time	Dry Gas Meter Reading (dcf)	Flow rate ~~Bulk Reading~~ (cuft/min)	~~Rotameter~~ Reading ORIFICE Mano in H_2O	Meter ~~Exit~~ Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Temp. Filter Inlet (°F)	Comments
0	18:30	896.800		1.8 ~~1.8~~	79	6	362	230	76	121	
5	18:35	899.629	.70	1.7	82	6	365	254	62	200	
10	18:40	903.100	.70	1.7	83	6	361	262	60	219	
13			.692	~~1.6~~	~~85~~	~~6.5~~	~~362~~	~~265~~	~~60~~	~~233~~	
15	18:45	906.537		1.6	85	6.5	362	265	60	233	
	End	907.364									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate ~~(cc/min)~~ (cuft/min)
Before	17	.002
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

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M19-NH_3-722

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CLIENT
TEST UNIT
PROJECT NO.
SYSTEM OPERATOR Kevin Rose
BAROMETRIC PRESSURE

TEST DATE 7/22/97
TEST NO.
SITE NO. 79
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time 1208	Dry Gas Meter Reading (dcf)	Sample Line H_s (~~Bleed Reading~~ (cc/min))	Pilot Tube H_s	~~Rotameter Reading~~ Sample Line Temp (°F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
0	[illegible]	762.16	0	0.79	254	78	0	382	208	72	239	
Start	1210	762.16	2.2	0.75 ~~2.20~~			9					
	~~1220~~											
	1218	Decreased flow rate to 2.2			~~255~~	~~80~~	~~9~~	~~381~~	~~245~~	~~66~~	~~245~~	
	1220	770.3	2.2	0.67	252	80	9	381	241	62	215	
	1223	772.9	2.2	0.70	253	71	9	381	256	67	235	
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	9	34 ml/ 0.02 cuft
After	14	22 ml/ "

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

10.5 cuft as good
~772.66 final

AQE 7/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-22-93 (Thurs.)	ORIFICE CORRECTION 2.002	HOT BOX NO. 3
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-NH4-722	METER CORRECTION 0.9812	COLD BOX NO. 3
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.485	CALIBRATION DATE 06-09-93	PROBE NO. 13-1
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 17.0" H2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION Port #6	CONTROL BOX NO. Six	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	1231	350.460	.06	1.74	1.74	94	92	3.0	659	~250°F	68°F	~250°F	Single Point
			.08	2.32	2.32	105	94	4.0	659				Isokinetic
			.08	2.32	2.32	111	95	4.0	658				Sampling for
			.08	2.32	2.32	117	93	4.0	654				30 minutes
		JTS	.08	2.32	2.32	119	94	5.0	659				
	1301	~~[illegible]~~	.08	2.32	2.32	119	94	5.5	659				Readings every
		376.022											5 minutes
	Δ=30 min	~~[illegible]~~	$(\Delta P)_{Avg}$ = .008	$(\Delta H)_{Avg}$ =2.22		$(T_{meter})_{Avg}$ = 102°F			$(T_{stack})_{Avg}$ = 658°F				
		Δ=25.562 dcf						Velocity = 22.7 ft/sec					
								Iso. = 99.6%					
													Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

PITOT LEAK CHECK

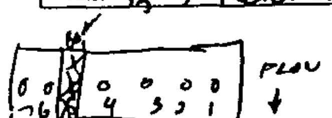
	Positive	Negative
Before	✓ 15 sec	OK 15 sec
After		

	1	2
CO2	14.0	14.0
O2	6.0	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL D.I. H2O	559.5	529.0	30.5
2.	100 mL 0.1N H2SO4	579.9	573.6	6.3
3.	100 mL 0.1N H2SO4	382.3	381.4	0.9
4.	200g Silica Gel	640.2	636.6	3.6
5.				

Actual Moisture

41.3g total



AQE 2/92

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STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-22-93 (Thurs.)	ORIFICE CORRECTION 1.802	HOT BOX NO. 7
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-NH4-722	METER CORRECTION 0.9617	COLD BOX NO. 2
PROJECT NO. 93C628-01	NOZZLE (SIZE, #) 0.195 G17	CALIBRATION DATE 5-17-93	PROBE NO. 7-2
CONTROL BOX OPERATOR TM	STATIC PRESSURE 0.15" H2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION D	CONTROL BOX NO. 7	STACK DIA. 60" (depth) X 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	12:45	979.480	1.10	1.26	1.26	104	98	4.0	200	~250°F	68°F	~250°F	Single Point
			1.10	1.26	1.26	108	94	4.0	201				Isokinetic
			1.10	1.26	1.26	111	95	4.0	200				Sampling for
			1.10	1.26	1.26	112	95	4.0	199				30 minutes
			1.10	1.26	1.26	113	97	4.5	199				
			1.10	1.27	1.29	118	97	4.5	200				Readings
	13:15	1000.090											every 5 minutes
	Δ=30 min	Δ=20.520 dcf	$(\Delta P)_{avg}$ = 1.10	$(\Delta H)_{avg}$ = 1.26		$(T_{meter})_{avg}$ = 103°F			$(T_{stack})_{avg}$ = 200°F				
								Velocity = 65.9 ft/sec					
								ISO. = 102.7%					Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.003
After	5.0	0.005

PITOT LEAK CHECK OSRC

	Positive	Negative
Before	oK	oK
After	oK	oK

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

MW = 29.3

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml 0.1N H_2SO_4 ~~50 ml DI H_2O~~	506.0	486.3	19.7
2.	100 ml 0.1N H_2SO_4	569.0	561.7	7.3
3.	Empty ~~100 ml 0.1N H_2SO_4~~	398.3	396.6	1.7
4.	200 g Silica Gel	671.5	666.3	5.2
5.				

33.9 g total

Actual Moisture = 8.1%

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AQF 7/93

N-18 - NH4 - 724

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[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

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CLIENT DOE
TEST UNIT Baghouse SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/29/93
TEST NO. N-18-NH4-724
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Flow Rate ~~Buck Reading~~ (ft³/min)	~~Rotameter~~ Reading Mano Orifice (in H2O)	Meter ~~Exit~~ Avg Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Temp. Filter Inlet (°F)	Comments
	17:45	~~[illegible]~~		1.1	89	1	367	295	86	113	
		28.100									
	17:50	31.660	.765	1.9	95	1	371	260	62	223	
	17:55	35.365	.745	1.8	98	2	370	261	61	239	
	18:00	39.012	.725	1.8	92	3	369	253	62	241	
	End	40.741									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	.0025
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO_2		
O_2		
CO		
N_2		

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Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

N-19-~~ALO~~ NH4-724

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
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[redacted] ~~EPA METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT ______ TEST DATE ______ DRY GAS METER NO. ______
TEST UNIT ______ TEST NO. ______ METER CORRECTION (Y) ______
PROJECT NO. ______ SITE NO. ______ CALIBRATION DATE ______
SYSTEM OPERATOR J. Kevin Rose STACK DIAMETER ______
BAROMETRIC PRESSURE ______ PORT DIRECTION ______

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Sample ~~Bulk~~ Reading in H_2O ~~(scfm)~~	Pitot Tube in H_2O	~~Rotameter~~ Reading Nozzle Temp (°F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
	1054	840.745	0	0.78	230	80	0	382	196	68	278	0
	1055	848.795	2.2	0.78	230	80	8	382	201	68	278	START
	1106	857.7	2.2	0.8	259	82	8	382	228	61	253	
	1208	859.85	2.2	0.8	267	83	8	382	238	62	257	Finish
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	15	173 ml/ 0.005 cu ft
After	15	120 ml/ .005 cu ft.

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Goal: 10.5 cu ft

AQE 7/92

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STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-24-93 (Sat.)	ORIFICE CORRECTION 1.975	HOT BOX NO. 3
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-NH4-724	METER CORRECTION 0.9921	COLD BOX NO. 7
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) 0.485	CALIBRATION DATE 07-16-93	PROBE NO. 73-1
CONTROL BOX OPERATOR ERC	STATIC PRESSURE 16.0" H_2O	PITOT CORRECTION 0.84	FILTER NO. [illegible]
BAROMETRIC PRESSURE 29.35	PORT DIRECTION Port #6	CONTROL BOX NO. [illegible] Box #1	STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90°	1145	893.135	.05	1.42	1.42	85	84	1.0	691	~250°F	<68°F	~250°F	Single Point
			.04	1.42	1.42	95	83	1.0	696				Isokinetic
			.06	1.70	1.70	99	78	2.0	691				Sampling 7
			.06	1.70	1.70	104	81	2.0	691				30 min.
			.06	1.70	1.70	108	82	2.0	686				
	1215	914.575	.06	1.70	1.70	111	[illegible]	2.?	680				Reading ea
													5 min
	Δ=30 min	Δ=21.440	$(\Delta P)_{AVG}$ =	$(\Delta H)_{AVG}$ = 1.61		$(T_{meter})_{AVG}$ = 91°F			$(T_{stack})_{AVG}$ = 689°F				
			0.06										
								Velocity = 20.0 ft/sec					
								Iso. = 101.9 %					
													Estimates:
													MW=29.2
													%H2O=[illegible]9

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	<0.015 cfm
After	5.5	<0.015 cfm

	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

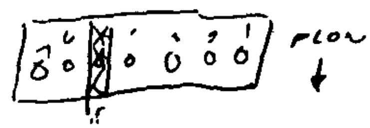
Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml 0.1N H_2SO_4	552.9	525.4	27.5
2.	100ml 0.1N H_2SO_4	575.1	570.0	5.1
3.	Empty	382.8	382.3	0.5
4.	Silica Gel	631.8	625.2	6.6
5.				

Ah Nois 8.C

39.7 g total

PITOT LEAK CHECK

POS.	NEG.
3"/15 sec.	3"/15 sec.



KEYSTONE

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STACK SAMPLING DATA SHEET

CLIENT Battelle DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 9X622-01
CONTROL BOX OPERATOR TM
BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-97 (Sat.)
TEST NO. N-21-NH4-724
NOZZLE (SIZE,#) 0.195 B17
STATIC PRESSURE 0.5" H2O
PORT DIRECTION D

ORIFICE CORRECTION 1.623
METER CORRECTION 0.9910
CALIBRATION DATE 5-19-97
PITOT CORRECTION 0.84
CONTROL BOX NO. 4

HOT BOX NO. 7
COLD BOX NO. 7
PROBE NO. 7-2
FILTER NO. -
STACK DIA. 50" (depth) × 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	11:45	533.460	1.0	1.06	1.06	[illegible]	[illegible]	5.0	203	~250°F	48°F	~250°F	Single Point
			1.0	1.06	1.06	110	90	5.0	205				Isokinetic
			1.0	1.06	1.06	112	92	5.0	205				Sampling for
			1.0	1.06	1.06	114	94	5.0	202				30 min
			1.0	1.06	1.06	115	94	5.0	201				
			1.0	1.06	1.06	115	94	5.0	200				Readings every
	12:15	551.550											5 min
	Δ=30 min	Δ=18.090 dcf	$(\Delta P)_{avg}$ = 1.0	$(\Delta H)_{avg}$ = 1.06		$(T_{meter})_{avg}$ = 102°F			$(T_{stack})_{avg}$ = 203°F				
								velocity = 63.1 ft/sec					
								Iso = 98.3%					
													Estimates:
													MW= 29.2
													%H2O= 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	<.02
After	5.0	<.02

PITOT LEAK CHECK 15 sec

POS.	NEG.
ok	ok

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml 0.1N H2SO4	505.1	484.3	20.8
2.	100ml 0.1N H2SO4	565.4	580.1	[illegible]5.3
3.	Empty	397.3	396.0	1.3
4.	200g Silica Gel	670.1	664.1	6.0
5.				

33.4g total

KEYSTONE

Actual Moisture = 8.7%

D-5: Cyanide Train

FIELD DATA

PLANT Niles
DATE 7/14/93
SAMPLING LOCATION 1B BH Inlet
SAMPLE TYPE
RUN NUMBER
OPERATOR Kurt Kenmare
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

N-18-~~[illegible]~~-719
CN

PROBE LENGTH AND TYPE SS, 4 ft
NOZZLE I.D. .242"
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ______ MINUTES

~~TRAVERSE POINT NUMBER~~ Clock time	SAMPLING TIME, min / ~~CLOCK TIME (24-hr CLOCK)~~	GAS METER READING (V_m), ft^3	~~VELOCITY HEAD (Δp_s), in. H_2O~~ Flow Rate ft³/min	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE ~~INLET~~ Avg ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE ~~OUTLET~~ ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	Prob Out °F
14:00	0	832.800										
14:02	c 2			1.7	1.7	361	95		9	259	63	193
14:10	c 10	838.633		1.7	1.7	365	98		10	257	60	221
14:20	c 20	845.638	.70	1.7	1.6	362	100		12	253	63	23[illegible]
14:29	c 29	852.065		1.7	1.7	363	100		14	259	66	24[illegible]
14:30	End	853.315										

COMMENTS:

EPA (Dur) 235

N-19-CN-719

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

Page of

CLIENT DOE/PETC
TEST UNIT
PROJECT NO. 62825
SYSTEM OPERATOR R.L. Smith
BAROMETRIC PRESSURE

TEST DATE 7/14/93
TEST NO. CN
SITE NO. 19
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO. 2
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp./Heated Line (°F)	Comments
	1357	688.692									
	1402	687.9			83	4	382	187	72	164/274	
	1407	691.9			83	4	382	225	68	171/271	
	1412	696.1			83	4	382	245	69	177/266	
	1417	699.8			84	4	382	254	69	185/264	
	1422	703.7			84	4	381	262	71	180/262	
	1427	707.055			84	4	381	265	71	183/263	
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-19-93 (Mon.)	ORIFICE CORRECTION (ΔH@) 2.002	HOT/COLD BOX NO. 1
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-CN-719	METER CORRECTION (Y) 0.9812	PROBE NO. 13-2
PROJECT NO. 93C028-01	NOZZLE (SIZE, in) 0.441"	CALIBRATION DATE 06-08-93	FILTER NO. —
TEST CREW RPC	STATIC PRESSURE 17.0" H2O	PITOT CORRECTION 0.84	STACK DIA.
BAROMETRIC PRESSURE 29.10	PORT DIRECTION Port 6	CONTROL BOX NO. Six	PORT SIZE 3G'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
90"	16:32	121.909	.05	1.02	1.02	93	92	1.0	639	~250°F	<68°F	~250°F	60 min./point
			.06	1.23	1.23	105	92	1.0	659				Single Point
			.07	1.43	1.43	113	93	1.5	656				Isokinetic
			.06	1.23	1.23	113	94	1.0	656				Sampling for
			.06	1.23	1.23	118	96	1.0	656				1 hour
			.06	1.23	1.23	121	99	2.0	659				
			.06	1.23	1.23	122	99	2.0	656				Readings every
			.06	1.23	1.23	121	99	2.0	660				5 minutes
			.06	1.23	1.23	123	99	2.5	661				
			.06	1.23	1.23	123	101	3.0	661				
			.06	1.23	1.23	124	101	4.0	660				
	17:32	160.085	.06	1.23	1.23	124	101	5.5	650				
	Δ=60 min	Δ=38.176 dcf	(ΔP)avg = 0.06	(ΔH)avg	=1.23	(Tmeter)avg	=	107°F	(Tstack)	= 656°F			
									velocity	= 19.7 ft/sec			Estimates:
									Iso.	= 104.6 %			MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL DI H2O	584.1	530.0	54.1
2.	100 mL 0.1M NaOH	579.3	565.7	13.6
3.	100 mL 0.1M NaOH	448.9	447.3	1.6
4.	200g Silica Gel	658.4	649.9	8.5
5.				

77.8g total

Actual Moisture = 9.8

AQE 6/92

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C620-01
TEST CREW TM TJ
BAROMETRIC PRESSURE 29.10

TEST DATE 7-19-93 (Mon.)
TEST NO. N-21-CV-719
NOZZLE (SIZE,#) 0.195" G17
STATIC PRESSURE 0.1" H_2O
PORT DIRECTION D

ORIFICE CORRECTION (ΔH@) 1.805
METER CORRECTION (Y) 0.9619
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 7

HOT/COLD BOX NO. 7
PROBE NO. 2-8
FILTER NO.
STACK DIA. 50" (depth) x
PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
50	18:30	744.423	1.05	1.21	1.21	96	84	4.5	198	~250°F	68°F	~250°F	6 U min./point
			1.05	1.21	1.21	112	86	5.0	198				Single Point
			1.05	1.21	1.21	114	85	5.0	198				Isokinetic
			1.05	1.22	1.22	120	86	4.5	198				Sampling for
			1.05	1.22	1.22	120	86	4.5	198				1 hour
			1.05	1.22	1.22	120	85	4.5	198				
			1.05	1.22	1.22	123	88	4.5	197				Readings every
			1.05	1.22	1.22	123	90	4.5	197				5 minutes
			1.05	1.22	1.22	123	90	4.5	195				
			1.05	1.22	1.22	123	90	4.5	195				
			1.05	1.22	1.22	123	90	4.5	197				
	[illegible]	783.580	1.05	1.22	1.22	123	90	4.5	192				
1930	[illegible]	783.580											
	Δ=60 min	Δ=41.157 dcf	$(\Delta P)_{avg}$ = 1.05	$(\Delta H)_{avg}$ = 1.22		$(T_{meter})_{avg}$ = 103°F			$(T_{stack})_{avg}$ = 197°F				Estimates:
									velocity = 69.8 ft/sec				MW= 29.2
									Iso. = 106.0 %				%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.008
After	5.0	0.009

PITOT LEAK CHECK 15 sec

	Positive	Negative
Before	ok	ok
After	ok	ok

GAS	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL ~~[illegible]~~ 0.1 M NaOH	615.7	571.6	44.1
2.	100 mL 0.1 M NaOH	574.6	556.0	18.6
3.	~~[illegible]~~ Empty	452.3	448.4	3.9
4.	200 g Silica Gel	667.2	652.1	15.1
5.				

81.7 g total AQE 6/92

Actual moisture = 9.6%

[illegible] = [illegible]

Cyunia
N-18-CN-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Baghouse
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/22/93
TEST NO. N-18-CN-722
SITE NO. 18 Inlet
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Back~~ Flow ~~Reading~~ Rate (cuft/min) ~~(cfmin)~~	~~Rotameter~~ Flow Reading orifice in H_2O	Meter ~~Avg Bath~~ Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Filter Inlet Temp. (°F)	Comments
	12:38	872.000		1.7	82	7	366	251	74	113	
	12:42	874.551	.71	1.7	90	7	365	265	60	212	
	12:48	879.705	.675	1.6	92	8	366	263	57	239	
	12:58	886.559	.69	1.6	94	10	364	260	57	257	
	13:08	893.428	.67	1.6	94	11	365	261	58	248	
	End	894.790									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cuft/min) ~~(cfmin)~~
Before	12	.025
After		

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 7/92

N-19-CN-722

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 26~~ SOURCE SAMPLING DATA SHEET

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CLIENT ______
TEST UNIT ______
PROJECT NO. ______
SYSTEM OPERATOR Kevin Ross
BAROMETRIC PRESSURE ______

TEST DATE 7-22-93
TEST NO. ______
SITE NO. 19
STACK DIAMETER ______
PORT DIRECTION ______

DRY GAS METER NO. ______
METER CORRECTION (Y) ______
CALIBRATION DATE ______

~~Traverse Point~~ (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Sample Hg	~~Bulk Reading (cc/min)~~ Pitot Tube Hz	~~Rotameter Reading~~ Sample Line Temp (F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
0	1314	773.6	0	~~0.2~~ 0.23	254	88	0	382	195	75	227	
Start	1316	773.6	2.2	~~0.28~~ 0.25	254	88	6	382	209	69	255	
10 min	1326	782.1	2.2	0.75	255	85	6	382	248	64	264	
20 min	1336	790.6	2.3	0.72	256	87	5.5	381	268	66	221	
25 min	1341	794.8	2.3	0.72	256	87	5.5	380	273	78	239	
end												
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	14	58
After	12.5	240

sec/cu ft

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

794.6

AQE 7/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-22-93 (Thurs.)	ORIFICE CORRECTION 2.002	HOT BOX NO. 3
TEST UNIT SR Reactor Outlet	TEST NO. N-20-CN-722	METER CORRECTION 0.9812	COLD BOX NO. 3
PROJECT NO. 93C828-01	NOZZLE (SIZE,#) 0.485	CALIBRATION DATE 06-09-93	PROBE NO. 13-1
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 17.0" H_2O	PITOT CORRECTION 0.84	FILTER NO. Cu W...
BAROMETRIC PRESSURE 29.38	PORT DIRECTION Port #2	CONTROL BOX NO. S-13	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	13:23	376.338	.08	2.32	2.32	95	91	5.0	650	~250°F	<68°F	~250°F	Single Point
			.06	1.74	1.74	110	90	5.0	661				Isokinetic
			.06	1.74	1.74	112	91	5.0	660				Sampling for
			.07	2.03	2.03	114	92	5.5	667				1 hour
			.07	2.03	2.03	115	93	5.5	661				
			.06	1.74	1.74	115	94	5.5	666				Readings every
			.07	2.03	2.03	119	95	6.5	679				5 minutes
			.07	2.03	2.03	120	96	6.5	678				
			.07	2.03	2.03	118	97	6.5	679				
			.07	2.03	2.03	121	97	6.5	679				
			.07	2.03	2.03	121	99	6.5	680				
	14 23	424.950	.07	2.03	2.03	121	99	6.5	680				
	Δ=60 min	Δ=48.612 dcf	$(\Delta P)_{avg}$ = 0.07	$(\Delta H)_{avg}$ = 1.98		$(T_{meter})_{avg}$ = 105F			$(T_{stack})_{avg}$ = 670F				Estimates:
								velocity = 21.4 ft/sec					MW= 29.2
								Iso.= 101.3%					%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 CFM
After	7.0	<0.015 CFM

PITOT LEAK CHECK

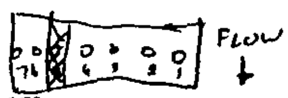
	Positive	Negative
Before	OK/15 sec	OK/15 sec
After	OK/15 sec	OK/15 sec

	1	2
CO2	14.0	14.0
O2	6.0	6.0
CO	0	0
N2	80.0	80.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	50 mL D.I. H_2O	584.8	528.5	56.3
2.	100 mL 0.1M NaOH	578.2	565.5	12.7
3.	100 mL 0.1M NaOH	451.6	449.1	2.5
4.	200g Silica Gel	668.2	658.4	9.8
5.				

81.3g total

Actual Moist 8.1%



AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR
BAROMETRIC PRESSURE 29.38

TEST DATE 7-22-93 (Thurs.)
TEST NO. M-21-CN-722
NOZZLE (SIZE,#) 0.175 817
STATIC PRESSURE 0.15" H_2O
PORT DIRECTION D

ORIFICE CORRECTION 1.802
METER CORRECTION 0.9617
CALIBRATION DATE 5-17-93
PITOT CORRECTION 0.84
CONTROL BOX NO. 7

HOT BOX NO. 7
COLD BOX NO. 2
PROBE NO. 7-2
FILTER NO.
STACK DIA. 50" (width) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	13:55	002.340	1.05	1.20	1.20	100	92	4.0	200	~250°F	48°F	~250°F	Single Point
			1.05	1.20	1.20	110	92	4.0	200				Isokinetic
			1.05	1.20	1.20	120	96	4.0	200				Sampling for
			1.05	1.22	1.22	120	96	4.0	200				1 hour
			1.05	1.22	1.22	120	96	4.0	200				
			1.05	1.22	1.22	120	97	4.0	200				Readings every
	14:55	042.930											10 minutes
	Δ=60 min	Δ=40.590 dcf	$(\Delta P)_{avg}$ = 1.05	$(\Delta H)_{avg}$ = 1.21		$(T_{meter})_{avg}$ = 105°F			$(T_{stack})_{avg}$ = 200°F				
									velocity = 64.5 ft/sec				
									Iso. = 104.4%				
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.012
After	4.0	0.010

PITOT LEAK CHECK 17 sec

	Positive	Negative
Before	ok	ok
After	ok	ok

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

MW = 29.2

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	~~[illegible]~~ 0.1M NaOH	624.3	572.0	52.3
2.	100mL 0.1M NaOH	567.2	555.9	11.3
3. (empty)	~~[illegible]~~	450.8	449.9	0.9
4.	200g Silica Gel	667.6	658.8	8.8
5.				

73.3g total

Actual Moisture = 8.8%

KEYSTONE

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 26~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Baghouse SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE
TEST DATE 7/24/93
TEST NO. N-18-CN-724
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION
DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Flow Rate ~~Delt~~ Reading (ft^3/min)	~~Rotometer~~ Reading Mano Orifice (in H2O)	Meter ~~Delt~~ Avg Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	~~Probe~~ Temp. Filter Inlet (°F)	Comments
	18:45	41.800									
	18:48		.71	1.7	95	8	373	268	63	212	
	18:50	45.288									
	18:55	48.708	.705	1.7	95	8.5	372	281	60	235	
	19:05	55.715	.71	1.7	99	9	370	257	59	239	
	19:15	62.688	.70	1.6	99	10	369	245	62	240	
	End	63.633									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (~~cc/min~~) (ft^3/min)
Before	16	.007
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO_2		
O_2		
CO		
N_2		

AQE 7/92

N-19-CN-724

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

Page of

CLIENT ______
TEST UNIT ______
PROJECT NO. ______
SYSTEM OPERATOR J Kevin Rose
BAROMETRIC PRESSURE ______

TEST DATE 7/24/93
TEST NO. ______
SITE NO. 19
STACK DIAMETER ______
PORT DIRECTION ______

DRY GAS METER NO. ______
METER CORRECTION (Y) ______
CALIBRATION DATE ______

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	sample ~~Bulk~~ Reading in H_2O (cc/min)	Pitot Tube in H_2O	Rotameter Reading sample line (F)	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
	1202	860.425	0	0.79	274	88	0	382	210	71	205	
	1202	860.425	2.1	0.8	273	87	4.2	381	220	71	224	START
	1211	868.1	2.15	0.84	272	88	4.3	381	249	66	241	
	1221	876.1	2.15	0.76	274	90	4.3	381	264	68	240	
	1233	884.885	2.18	0.83	272	94	4.3	381	277	71	257	End
												Estimates:
												MW=
												%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (~~cc/min~~)
Before	18	75 sec/.005 cuft
After	15	62 sec/.005 cuft

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

good < 21 cu ft

AQE 7/92

page 1 of 1

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)
TEST NO. N-20-CN-724
NOZZLE (SIZE,in) 0.485
STATIC PRESSURE 16.0" H_2O
PORT DIRECTION Port #6

ORIFICE CORRECTION 1.975
METER CORRECTION 0.9921
CALIBRATION DATE 07-16-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Battelle box #1

HOT BOX NO. 3
COLD BOX NO. 7
PROBE NO. 13-1
FILTER NO.
STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	12:30	915.400	.06	1.70	1.76	89	85	1.0	690	~250°F	<68°F	250°F	Single Poi
			.06	1.70	1.70	108	87	2.0	682				Isokinetic
			.06	1.70	1.70	112	89	2.0	686				Sampling f
			.06	1.70	1.70	116	95	2.0	691				1 hour
			.07	1.99	1.99	119	92	3.0	699				
	13:30	959.388	.07	1.99	1.99	120	92	3.0	695				Readings e
													10 minute
	Δ=60 min	Δ=43.988 dcf	$(\Delta P)_{avg}$ =	$(\Delta H)_{avg}$	=1.80	$(T_{meter})_{avg}$	=100°F		$(T_{stack})_{avg}$	= 691°F			
			0.06										

velocity = 20.0 ft/sec

Iso. = 103.1%

Estimates:
MW = 29.2
%H2O = 9

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	≤0.01 cfm
After	5.5	<0.01 cfm

	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100mL 0.1 M NaOH	586.7	530.8	55.9
2.	100mL 0.1 M NaOH	578.9	568.3	10.6
3.	Empty	450.9	448.9	2.0
4.	Silica Gel	652.9	640.9	12.0
5.				

80.5 g

PITOT LEAK CHECK

POS.	NEG.
0"/15sec	0"/15sec

0	0	0	0	0	0
7	6	4	3	2	1

FLOW

KEYSTONE

Page 1

STACK SAMP NG DATA SHEET

CLIENT Battelle /DOE	TEST DATE 7-24-93 (Sat.)	ORIFICE CORRECTION 1.673	HOT BOX NO. 7
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-CN-724	METER CORRECTION 0.9912	COLD BOX NO. 2
PROJECT NO. 92C 0228-01	NOZZLE (SIZE,#) 0.195 617	CALIBRATION DATE 5-19-93	PROBE NO. 7-2
CONTROL BOX OPERATOR JM	STATIC PRESSURE 0.5" H2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION D	CONTROL BOX NO. 4	STACK DIA. 58" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	12:30	551.610	1.05	1.11	1.11	90	80	5.0	205	~250°F	68°F	~250°F	Single Point
			1.05	1.11	1.11	95	81	5.0	205				Isokinetic
			1.05	1.11	1.11	102	84	5.0	202				Sampling for
			1.05	1.11	1.11	110	86	5.0	200				1 hour
			1.05	1.11	1.11	114	88	5.0	200				
			1.05	1.11	1.11	116	89	5.0	202				Reading every
	13:30	588.735											10 min
	Δ=60 min	Δ=37.125 dcf	$(\Delta P)_{avg}$ = 1.05	$(\Delta H)_{avg}$ = 1.11		$(T_{meter})_{avg}$ = 95°F			$(T_{stack})_{avg}$ = 202°F				
								velocity = 64.6 ft/sec					
								Iso. = 99.7%					
													Estimates:
													MW = 29.2
													%H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	<.02
After	5.0	<.02

PITOT LEAK CHECK ,53LC

POS.	NEG.
oK	oK

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL 0.1M NaOH	619.1	572.0	47.1
2.	100 mL 0.1M NaOH	564.8	555.4	9.4
3.	Empty	450.1	449.2	0.9
4.	Silica Gel	664.0	655.7	8.3
5.				

65.7 g total

KEYSTONE

Actual Moisture = 8.7%

D-6: Aldehyde Trains

As noted in Section 3.2.4, no aldehyde samples were taken at Locations 20 and 21 on July 18, 1993. Those samples were made up by conducting two aldehyde sampling runs at those locations on July 23.

Aldehydes

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 0011~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE-METC
TEST UNIT Niles -SNOX
PROJECT NO. ____
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE ____

TEST DATE ____
TEST NO. N-1B-ALD-718
SITE NO. 18
STACK DIAMETER ____
PORT DIRECTION ____

DRY GAS METER NO. ____
METER CORRECTION (Y) ____
CALIBRATION DATE ____

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading ~~(dcf)~~ L	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	~~Impinger Temp.~~ Filter Inlet °F ~~(°F)~~	Probe Temp. (°F)	Comments
	0	414.95			88	2	263	259	150	107	
	15	431.35			87	2	362	257	167	132	
	63.5	479.74									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before		
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

Aldehyde
N-18-ALD-721

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Baghouse
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/21/93
TEST NO. N-18-ALD-721
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

~~Traverse Point~~ Sample No. (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Duct Reading~~ Flow rate (Lit ~~Cu~~/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	~~Impinger~~ Temp. Ice Bath °C	Probe Temp. (°F)	~~Comments~~ Filter Inlet Temp °F
	15:59	519.20	.97 lit/min			1.5	367	295	0	87	~~105~~ 117
	16:19	532.50	.90 lit/min			1.5	370	271	1	137	132
	16:19		.99								
	16:29	548.29	1.06			1.5	373	250	0	177	131
	16:45	565.67	1.15			2.0	373	255	0	202	159
	16:59	579.52	0.95			2.0	369	257	1	207	149
	End	581.10									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (~~in. Hg~~)	Rate (lit ~~acf~~/min)
Before	15	.05
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

Date: 7/21/93
K. Rose

N-19-ALD-721

Time	Flow rate	Vacuum Hg	Liters Dry Gas meter rdg	Duct Temp °F	Oven Temp °F	Notes
1608	40	0	0482.0	33	222	Start
1623	40	0	0490.0	33	244	15 min.
1638	40	0	0498.0	33	259	30 min
1708	40	0	0514.32	37	253	60 min

ALD-5

STACK SAMPLING DATA SHEET

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CLIENT Battelle/DOE
TEST UNIT SCR Reactor Outlet Site 20
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR M.G
BAROMETRIC PRESSURE 29.28

TEST DATE 07/21/93 (Wed)
TEST NO. N-20-ALO-721
NOZZLE (SIZE,#) Glass Tube
STATIC PRESSURE 17.0" H_2O
PORT DIRECTION #2

ORIFICE CORRECTION —
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION 0.84
CONTROL BOX NO. 06M-934586555

HOT BOX NO. NCA 3
COLD BOX NO. mini smp
PROBE NO. Glass
FILTER NO. —
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading dry l	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1045	59.540		cc/min	1055	68	68	0.0	657	250	<68	245	one point
					1045	68	68	0	661				
					1051	68	68	0	658				
					1035	68	68	0	645				
					1038	67	67	0	655				
					1033	67	67	0	655				
					1035	67	67	0	652				
					1035	67	67	0	653				
					1040	67	67	0	651				
					1042	67	67	0	645				
					1030	66	66	0	647				
					1033	66	66	0	643				
	2145	121.753			1025	66	66	0	645				
	Δ=60	Δ=62.213				$(T_{meter})_{avg}$	=67°F		$(T_{stack})_{avg}$	= 651°F			Estimates:
	min	dry Liters											MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	4.0	10.5
After	3.5	4.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.5	
CO	0	
N2	79.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	Empty	95.1	96.0	-0.9
2.	20 mL DNPH	95.9	95.9	0.0
3.	20 mL DNPH-dry	79.9	79.4	0.5
4.	Silica Gel	101.9	98.5	3.4
5.				

(3.0 g total)

Actual Moisture 6.3%

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C828-01
CONTROL BOX OPERATOR TM
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed)
TEST NO. N-21-AD-721
NOZZLE (SIZE,#) 0.195 817
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION S

ORIFICE CORRECTION —
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Nutech #500304

HOT BOX NO. 1
COLD BOX NO. 1
PROBE NO. 7-2
FILTER NO. —
STACK DIA. 58" (depth) × 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry Liters	Pitot Δ P (in. H2O)	Orifice Δ H Reqd. (in. H2O)	Orifice Δ H Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	30:45	6619.80		1000 cc/min		78		1.0	195	~280°F	68°F	~250°F	Single Point
	35			999		78		1.0	195				Sampling at
	40			1002		78		1.0	195				1 l/min for
	45			1000		77		1.0	195				60 min
	50			1003		78		1.0	195				
	55			1006		78		1.0	197				
	60			1004		77		1.0	197				1000 cc/min
	05			998		77		1.0	199				
	10			999		77		1.0	198				
	15			999		77		1.0	195				
	25			1001		76		1.0	197				
	30			1001		76		1.0	197				
	31:45	6675.20											
													Estimates:
	Δ = 60 min	Δ = 55.40 dry Liters				$(T_{meter})_{AVE}$ = 77°F			$(T_{stack})_{AVE}$ = 196°F				MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	6.0	<10
After	8.0	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	12.0	
O2	7.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	~~[illegible]~~			
2.	20 mL DWPH	93.8	95.8	-2.0
3.	20 mL DWPH	93.4	93.6	-0.2
4.	~~Silica Gel~~ Dry	79.6	79.3	0.3
5.	Sil. Gel	103.3	99.5	3.8

1.9 total

Actual Moisture 4.5%

KEYSTONE

AQE 2/92

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KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD 6A~~ SOURCE SAMPLING DATA SHEET

CLIENT: DOE
TEST UNIT: Baghouse ~~Inlet~~ SNOX
PROJECT NO.: Niles
SYSTEM OPERATOR: Kent Rennie
BAROMETRIC PRESSURE:

TEST DATE: 7/27/93
TEST NO.: N-18-BLD-723
SITE NO.: Inlet 18
STACK DIAMETER:
PORT DIRECTION:

DRY GAS METER NO.:
METER CORRECTION (Y):
CALIBRATION DATE:

Traverse Point (inches)	Clock Time	Dry Gas Meter Reading (dcf)	Flow Rate ~~Buck Reading~~ (lit/min) ~~(cc/min)~~	Rotameter Reading	~~Meter Exit~~ Ice Bath Temp. °C	Vacuum (in. Hg)	Stack Temp. (°F)	Hot Box Temp. (°F)	~~Impinger~~ Filter Inlet Temp. (°F)	Probe Temp. (°F)	Comments
	11:35	608.90		.80	0	2	362	249	111	105	
	11:40	612.80	.80 lit/min	.95	1	2	366	269	119	119	
	11:45	617.45	.86	.95	1	2	367	266	136	142	
	11:50	622.28	1.10	1.05	0	2	366	256	144	158	
	12:05	636.89	1.08	1.00	0	2	369	248	150	188	
	12:20	651.53	0.91	1.0	0	2	366	257	151	213	
	12:36	667.75	0.98	1.05	1	2	368	257	156	230	
End	12:42	671.20									
											Estimates:
											MW=
											%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate ~~(cc/min)~~ (lit/min)
Before	17	.01
After		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

J. Kevin Rose
BM2 X-3901 = VOST 2E0/01B

~0.5 L/min
Time = 60 min.

Initial Vacuum Check = ~2 min / .01 cuft

Time	Vacuum (Hg)	Flow (psi)	Liters Gas Meter (cfs)	Oven Temp(°F)	Bath Temp(°F)
1108	0	39.5	0540.7	201	36
1128	0	39.0	0551.0	256	36
1148	0	40.0	0562.0	256	36
1208	0	40.0	0572.55	256	35

Final ~~[illegible]~~ vacuum check = ~2 min / 0.01 cuft.

ALD-9

7-23-93 (PM.)

N-20-AD-723-1

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE	TEST DATE 7-23-93 (PM.)	ORIFICE CORRECTION —
TEST UNIT SCR Reactor outlet	TEST NO. N-20-AD-723-1	METER CORRECTION 0.9735
PROJECT NO. 93 C 628.01	NOZZLE (SIZE, ft) Glass Tube	CALIBRATION DATE 06/14/93
CONTROL BOX OPERATOR M. Co	STATIC PRESSURE 15.5	PITOT CORRECTION 0.84
BAROMETRIC PRESSURE 29.38	PORT DIRECTION Port #8 3A	CONTROL BOX NO. DG M 934 586555

HOT BOX NO. 3
COLD BOX NO. 3
PROBE NO. —
FILTER NO. —
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (liters)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1420	072.440		≈1,000	1065	80	80	0.0	655	250°F	48°F	250°F	Single Point
	1425				1024	80	80	0.0	657	250	54	250	Sampling at
	1430				1056	80	80	0.0	657	250	48	255	1 L/min for
1435	~~1440~~				1052	81	81	0.0	656	250	43	255	60 min.
1440	~~1445~~				1018	81	81	0.0	653	255	42	253	
	1445				1031	81	81	0.0	654	255	44	255	
	1450				1031	81	81	0.0	654	255	45	255	
	1455				1034	81	81	0.0	655	255	46	255	
	1500				1021	80	80	0.0	655	250	46	255	
	1505				988	80	80	0.0	655	250	46	255	
	1510				1020	80	80	0.0	655	250	47	250	
	1515				1012	80	80	0.0	652	250	47	250	
	1520	134.280			1035	80	80	0.0	654		47		
	Δ=60 min	Δ=61.840 dry liters				$(T_{meter})_{AVG}$ = 80°F			$(T_{stack})_{AVG}$ = 655°F				Estimates: MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min)
Before	4.0	10.2
After	4.0	0.0

PITOT LEAK CHECK

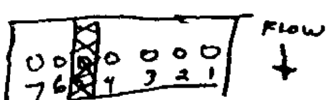
	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents DI PH	Final	Initial	Difference
1.	20 mL ~~DI PH~~	96.2	96.8	-0.6
2.	20 mL DI PH	96.1	95.6	0.5
Empty 3.	~~20 mL DI PH~~	79.8	79.8	0.0
4.	Silica Gel	100.7	97.4	3.3
5.				

(3.2 g) total

Actual Moisture 6.7%



AQE 2/92

KEYSTONE

N-20-AD-723-2

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-23-93 (Fri)	ORIFICE CORRECTION (ΔH@) —	HOT/COLD BOX NO.
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-AD-[illegible]	METER CORRECTION (Y) 0.9735	PROBE NO.
PROJECT NO. 93C028-01	NOZZLE (SIZE,IN) Glass Tube 72-2	CALIBRATION DATE 06/14/93	FILTER NO. —
TEST CREW MG	STATIC PRESSURE 15.5" H2O	PITOT CORRECTION 0.84	STACK DIA.
BAROMETRIC PRESSURE 29.[illegible]38	PORT DIRECTION #3	CONTROL BOX NO. [illegible]934586535	PORT SIZE

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (liters)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	1608	140.810		≅1,000	1065	80	80	0.0	655	350°F	<68°F	~250°F	min./point
	1613				1054	80	80	0.0	658				Single Point
	1618				1051	80	80	0.0	657		41	250	Sampling at
	1623				1048	80	80	0.0	659				1 L/min for
	1628				1041	80	80	0.0	656		42	250	60 min
	1632				1044	80	80	0.0	653		43		
	1638				1021	80	80	0.0	654		42	250	
	1643				1025	80	80	0.0	657				
	1648				1009	80	80	0.0	657		41	250	
	1653				995	80	80	0.0	656				
	1658				972	80	80	0.0	656		43	250	
	1703				1027	80	80	0.0	654				
	1708	202.595			1044	80	80	0.0	657		43		
		202.595											
	Δ=60 min	Δ=61.785 dry liters				$(T_{meter})_{AVG}$	=80	$(T_{stack})_{AVG}$	=656°F				Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	4.0	0.0
After	4.0	0.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	~~20mL [illegible]~~	95.2	95.3	-0.1
2.	20mL DNPH	95.5	95.4	0.1
3.	Empty ~~20mL DNPH~~	79.9	79.8	0.1
4.	Silica Gel	100.3	97.0	3.3
5.				~~2.8~~

Actual Moisture 7.3%

3.4 g H2O

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STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TN
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri)
TEST NO. N-21-AD-723-1
NOZZLE (SIZE,#) ~~[illegible]~~
STATIC PRESSURE 0.7" H2O
PORT DIRECTION [illegible]

ORIFICE CORRECTION ——
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION 0.84
CONTROL BOX NO. N. Gen # 504704

HOT BOX NO.
COLD BOX NO.
PROBE NO. 7-2
FILTER NO.
STACK DIA. 50" (depth) x 9' (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (Liters)	~~[illegible]~~ cc/min (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	14:20	6729.49	1002			86		1.0	202	~250°F	<68°F	~250°F	Single Point
	[illegible]		997			85		1.0	202				Not Isokinetic
	[illegible]		1004			85		1.0	200				Sampling for
	35		1002			85		1.0	200				60 min
	[illegible]		1004			84		1.0	200				at 1 L/min
	[illegible]		1000			84		1.0	202				
	[illegible]		997			84		1.0	202				
	55		999			84		1.0	201				
	[illegible]		1002			84		1.0	201				
	[illegible]		1002			84		1.0	201				
	[illegible]		1000			83		1.0	200				
	15		1001			84		1.0	200				
	15:20	6787.05											
	Δ=60 min	Δ=57.56 dry Liters				$(\bar{T}_{meter})_{avg}$ = 84°F			$(\bar{T}_{stack})_{avg}$ = 201°F				Estimates:
													MW = 29.2
													%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	5.0	< 20
After	5.0	< 20

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents DNPH	Final	Initial	Difference
1.	~~[illegible]~~	96.7	97.7	-1.0
2.	20 mL DNPH	92.8	93.4	-0.6
Empty 3.	~~[illegible]~~	79.7	79.4	0.3
4.	Silica Gel	104.2	102.4	1.8
5.				

Actual Moisture (1.0 g) 0.5 g total

KEYSTONE

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-18-93 (Sun)	ORIFICE CORRECTION (ΔH@)	—
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-VOS-718-3	METER CORRECTION (Y)	0.9735
PROJECT NO.	93C628-01	NOZZLE (SIZE,#)	—	CALIBRATION DATE	06/14/93
TEST CREW	MG	STATIC PRESSURE	17.0" H_2O	PITOT CORRECTION	—
BAROMETRIC PRESSURE	29.70	PORT DIRECTION	#3	CONTROL BOX NO.	QCA-1345B655

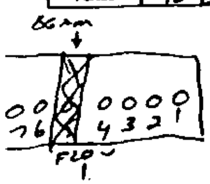
HOT/COLD BOX NO. —
PROBE NO.
FILTER NO. —
STACK DIA. X
PORT SIZE

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (ft³) Liters	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	1725	18.300		570		81	81	2.5	688	255	44	250	min./point
				562		81	81	2.5	688				VOST TUBE #3
				554		81	81	2.5	689				0.5 L/min
				543		80	80	2.5	688		45		30 min run
	1755	34.970		545		80	80	2.5	689	255		250	
	Δ=30	Δ=16.670				(T meter)avg	=81°F		(T stack)avg	=688°F			Tenax #T058
	min	dry Liters											Tenax #TC067
													Charcoal #TC[illegible]
													Estimates:
													MW= 29.2
													%H2O=9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10.0	19.5
After	10.0	18.4

<4% of average flow rate



PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Batelle / DOE	TEST DATE 7-12-93 (Sun)	ORIFICE CORRECTION (ΔH@) —	HOT/COLD BOX NO. —
TEST UNIT SNOX Tower Outlet	TEST NO. N-21- VOS-718-1	METER CORRECTION (Y) 0.9993	PROBE NO. 7-2
PROJECT NO. 93648 28-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 4-23-93	FILTER NO. —
TEST CREW MG, TS, TM	STATIC PRESSURE 0.9" H_2O	PITOT CORRECTION —	STACK DIA. [illegible]" (depth) x
BAROMETRIC PRESSURE 29.30	PORT DIRECTION A	CONTROL BOX NO. Nutech # 500304	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (liters)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	1821	[illegible]	6539.56	0.5 l/min		84		2.0		250°F		260°F	5 min./point
		[illegible]											Vost tube #1
	1826	[illegible]	6541.60			84		2.0					0.5 l/min
													5 min run
	Δ=5	Δ=2.04	dry liters			(T meter)avg = 84°F							
	min												
													Temp #7871
													Temp [illegible]
													channel # TC075
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(cfm)min
Before	10	10
After	10	10

2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before	•	
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

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CLIENT Battelle/DOE	TEST DATE 7-18-93 (Sun)	ORIFICE CORRECTION (ΔH@) —	HOT/COLD BOX NO. —
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-VOS-718-2	METER CORRECTION (Y) 0.9993	PROBE NO. 7-2
PROJECT NO. 93C828-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 4-23-93	FILTER NO. —
TEST CREW MG, JTS, TM	STATIC PRESSURE 0.9" H_2O	PITOT CORRECTION —	STACK DIA. 50" (depth) x
BAROMETRIC PRESSURE 29.30	PORT DIRECTION A	CONTROL BOX NO. Nutech #500304	PORT SIZE 99" (Width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	1853	~~[illegible]~~	6545.93	0.5 L/min		85		5.0		250°F		250°F	10 min./point
													VST TUBE #2
	1903		6554.90										0.5 L/min
													10 min/pt
	Δ =	Δ = 8.97 dry Liters											
	10 min												
													Temp #TØ7Ø
													Temp #+
													Channel #TCØ64
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate, cc/min
Before	10	10
After	7	10

2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE	TEST DATE 7-18-93 (Sun)	ORIFICE CORRECTION (ΔH@) —	HOT/COLD BOX NO. —
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-VOS-718-3	METER CORRECTION (Y) 0.9993	PROBE NO. 7-2
PROJECT NO. 93C4228-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 4-23-93	FILTER NO. —
TEST CREW JPS	STATIC PRESSURE 0.9" H_2O	PITOT CORRECTION —	STACK DIA. 58' (depth) K
BAROMETRIC PRESSURE 29.30	PORT DIRECTION A	CONTROL BOX NO. Nutech #500304	PORT SIZE 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (ft³) Liters	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	1924	6554.55		0.54/min		87		5.0		250°F		250°F	30 min./point
													VOST Tube 3
	1934					89		5.0					0.5 L/min
													30 min run
	1944					90		5.0					
	1954	6567.00				92		5.0					Tenax # T072
													Tenax #
													Charcoal # TC061
	Δ = 30 min	Δ = 12.45	dry Liters			Tank ave	= 91°F						
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min) min
Before	10.0	10
After	7.0	10

2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	
O2	5.0	
CO	0	
N2	82.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] ~~EPA METHOD~~ SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Baghouse / SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kard Rennie
BAROMETRIC PRESSURE

TEST DATE 7/21/93
TEST NO. N-1B - VOS - 721
SITE NO. Inlet 1B
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

	~~Traverse Point~~ Sample Name (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Buck~~ Reading flow rate (lit ~~cc~~/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	~~Hot Box~~ Temp. Ice Bath °C ~~(°F)~~	Impinger Temp. Condenser °C ~~(°F)~~	Probe Temp. (°F)	Comments
A	T065	13:50	489.70	.75 lit/min			3.5	367	3	17	160	
	TC063	13:55		.53			3.0	367	3	16	171	
		End	493.53									
B	T062	14:12	494.35	.49 lit/min			3.0	369	3	14	162	
	TC061	14:17	497.07	.65			3.0	367	3	14	171	
		14:22	499.93	.44			3.0	368	3	13	186	
		End	500.35									
C	T064	14:35	500.42	.40 lit/min			3.0	370	3	14	186	
	TC062	14:45	505.31	.57 lit/min			3.2	369	5	13	195	
		14:56	511.11	.48			3.0	367	5	14	204	Estimates:
		15:06	516.19	.48			3.2	370	6	13	209	MW=
		End	517.17									%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)	
~~Before~~	15	.01	5 min run
~~After~~	15	.01	10 " "
	15	.01	30 " "

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

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5, 10, 30 min. runs. VOST
K. Rose
7/21/93

N-19 ~ VOST 921

Time hh:mm	Bath Temp. °C	Flow meter rdg.	Column Temp. °C	Vacuum Hg	Gas Meter Start	Gas Meter Stop	
30 sec.					~~0443.0~~		5 min Run
Start 1335	14	38	29	3.8	0443.0		
Stop 1340	16	39 40	29	3.8		0445.95	
					0447.0 START ~~0447.32~~		10 min. Run
START 1353	17	40	26	3.0			
1358	14	40	27	3.0	0450.0		
STOP 1403	14	40	28	3.0		0462.32 Stop	
START 1416:	15	40	26	3.0	0453.0 Start		~~30 min. Run~~
1422	14	40	27	3.0	0456.0		Ran for 53 min
1431	14	40	28	3.0	0460.0		
1441	14	40	27	4.5	0466.0		
~~1446~~ 1459	13	40	27	3.5	0475.0 ~~0475.0~~		
1508	14	39	27	5.0	0480.0		
1510	14	39	27	5.0	0480.75 Stop		

STACK SAMPLING DATA SHEET

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CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR M. Co
BAROMETRIC PRESSURE 29.38

TEST DATE 7-28-93 (Wed.)
TEST NO. A1-20-V05-728-1
NOZZLE (SIZE, in) Glass tube
STATIC PRESSURE 17.0" H2O
PORT DIRECTION #Co

ORIFICE CORRECTION 0.9735 ΔH@
METER CORRECTION [illegible]
CALIBRATION DATE 06/14/93
PITOT CORRECTION —
CONTROL BOX NO. DGM-934SB6535

HOT BOX NO. 3
COLD BOX NO. 3
PROBE NO. 5-0
FILTER NO. None
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	~~Impinger~~ Cond. Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1450	51.260		cc/min	556	75	75	1.0	645	250°F	<68°F	250°F	VOST Tube #1
								~~1.0~~					
	1455	54.375			560	75	75	1.0	645	260	41	245	5 min run
													at 0.54/min
	Δ=5	Δ=3.115				(T meter)avg = 75°F			(T stack)avg = 645°F				
	min	dry Liters											
												Temp #T074	
												Temp + Channel #TC0:	
													Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10.0	0.0
After	10.0	3.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

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STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR M.G
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed.)
TEST NO. N-20-VOS-721-2
NOZZLE (SIZE,#) Glass Tube
STATIC PRESSURE 17.0" H_2O
PORT DIRECTION 6 ft

ORIFICE CORRECTION ——
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION 0.84
CONTROL BOX NO. Dem-9345B6535

HOT BOX NO. 3
COLD BOX NO. 3
PROBE NO. 5-0
FILTER NO. None
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (L) Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1525	64.022		cc/min	554	75	75	1.0	654	250°F	48°F	250°F	VOST Tube #2
					538	75	75	1.0	653	265	40	245	
	1535	69.845			543	75	75	1.0	654		39		10 min run at
													0.5 L/min
	Δ=10	Δ=5.823				$(T_{meter})_{avg}$	= 75°F		$(T_{stack})_{avg}$	= 654°F			
	min	dry Liters											
												TC#1	T073
												TC#2 &	
												channel 1	TC070
													Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10.0	0.0
After	10.0	0.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

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STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-21-93 (Wed.)	ORIFICE CORRECTION —	HOT BOX NO. 3
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-VOS-721-3 A1	METER CORRECTION 0.9735	COLD BOX NO. 3
PROJECT NO. 93C020-01	NOZZLE (SIZE,in) Glass Tube	CALIBRATION DATE 6-14-93	PROBE NO. 5-6
CONTROL BOX OPERATOR MB	STATIC PRESSURE 17.0" H_2O	PITOT CORRECTION 0.84	FILTER NO. —
BAROMETRIC PRESSURE 29.28	PORT DIRECTION #6	CONTROL BOX NO. DGM-93036535	STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1652	~~16~~ 74.459		cc/min	540	75	75	2.0	653	250°F	<68°F	250°F	VOST Tube #3
		74.459			501	75	75	2.0					
					532	75	75	2.0	645	265	42	243	30 min run at
					558	75	75	2.0					0.5 L/min
					505	75	75	2.0	650	266	42	244	
					511	75	75	2.0					
	1622	~~89.580~~			535	75	75	2.0	651	264	43	245	
		90.580											
	MD											Tenax F	
												T068	
	Δ=30	Δ=16.121				$(T_{meter})_{avg}$ = 75°F		$(T_{stack})_{avg}$		= 650°F		TC069	← Tenax + Charcoal #
	min	dry liters											
													Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10.0	7.5
After	10.0	5.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

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KEYSTONE

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle/DOE	TEST DATE 07/21/93	ORIFICE CORRECTION —	HOT BOX NO. 3		
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-VOS-721-4	METER CORRECTION 0.9735	COLD BOX NO. 3		
PROJECT NO. 93C028-01	NOZZLE (SIZE,ft) —	CALIBRATION DATE 06/14/93	PROBE NO. 5-0		
CONTROL BOX OPERATOR MG	STATIC PRESSURE 17 "H2O	PITOT CORRECTION —	FILTER NO. —		
BAROMETRIC PRESSURE 29.28	PORT DIRECTION #6	CONTROL BOX NO. DGM-9345866535	STACK DIA.		

Traverse Point (inches)	Time	Dry Gas Meter Reading (~~ft3~~ ℓ)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1740	1.042		cc/min	1036	74	74	4.5			41		10 min
					1031	74	74	4.5					audit sample
	~~1755~~	11.445			1037	74	74	4.5			43		
	1750	MAD											
	Δ=10	Δ=10.403				(Tmeter)avg = 74°F						Texas #	TD16A
	min	dry Liters										reverse	
												Channel #	TC043A
													Estimates:
													MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cc/min)
Before	10.0	0.0
After	10.0	0.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE
TEST UNIT SCR Reactor outlet
PROJECT NO. 93C020-01
CONTROL BOX OPERATOR M.G.
BAROMETRIC PRESSURE 29.28

TEST DATE 07/21/93
TEST NO. N-20-VOS-721-5
NOZZLE (SIZE,#) —
STATIC PRESSURE 17" H2O
PORT DIRECTION #6

ORIFICE CORRECTION —
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION —
CONTROL BOX NO. DGM-934586

HOT BOX NO. 3
COLD BOX NO. 3
PROBE NO. 5-0
FILTER NO. —
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading dry (l)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1805	16.770		cc/min	1034	74	74	4.0			40		10 min
					1037	74	74	4.0					outlet sample
	1815	27.131			1040	74	74	4.0			40		
	Δ=10	Δ=10.361				(Tmeter)	= 74°F						
	min	dry Liters											
												Tenax	#T047A
												Tenax	
												Charcoal	#TC029A
													Estimates:
													MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10.0	3.2
After	10.0	0.0

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT	Battelle/DOE	TEST DATE	07/21/93	ORIFICE CORRECTION	—
TEST UNIT	SCR Reactor Outlet	TEST NO.	N-20-VOS-721-6	METER CORRECTION	0.9735
PROJECT NO.	93C028-01	NOZZLE (SIZE,ft)	—	CALIBRATION DATE	06/14/93
CONTROL BOX OPERATOR	M.C.	STATIC PRESSURE	12"H2O	PITOT CORRECTION	—
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	#6	CONTROL BOX NO.	06m-9345868

HOT BOX NO.	3
COLD BOX NO.	3
PROBE NO.	5-6
FILTER NO.	
STACK DIA.	—

Traverse Point (inches)	Time	Dry Gas Meter Reading dry (L)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Cage Temp. (°F)	Hot Box Temp. (°F)	Comments
	1832	33.313		cc/min	1040	74	74	4.0			42		
					1044	74	74	4.0					
	1842	43.810			1046	74	74	4.0			46		
	Δ=10 min	Δ=10.497 dry Liters				(Tinlet)AB	=74°F						
												TENAX	#T003A
												TENAX	
												charcoal	#TC0454
													Estimates:
													MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cc/min)
Before	10.0	5.5
After	10.0	7.7

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle/DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR JPS
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed.)
TEST NO. N-21-VOS-721-1
NOZZLE (SIZE,#) —
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION D

ORIFICE CORRECTION —
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION —
CONTROL BOX NO. Nutech #500304

HOT BOX NO. —
COLD BOX NO. —
PROBE NO. 7-2
FILTER NO. —
STACK DIA. 58"(approx.)

Traverse Point (inches)	Time	Dry Gas Meter Reading dry liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
		~~[illegible]~~		500cc/min		89		3.0		250°F			5 min run -
	1526	6578.37											VOST Tube #1
													0.5 L/min
	1531	6580.20				90		3.0					
	Δ=5	Δ=1.83				(Tmeter)avg = 90°F							
	min	dry liters											
												Tenax # T007A	
												Tenax+Charcoal #	
												TC032A	
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TJS
BAROMETRIC PRESSURE 29.28

TEST DATE 7-21-93 (Wed)
TEST NO. N-21-VOS-728-2
NOZZLE (SIZE,#) —
STATIC PRESSURE 0.8" H_2O
PORT DIRECTION D

ORIFICE CORRECTION —
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION —
CONTROL BOX NO. Nutech #600304

HOT BOX NO. —
COLD BOX NO. —
PROBE NO. 7-2
FILTER NO. —
STACK DIA 50" (approx) x 99" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1553	6583.90		500cc/min		92		3.0		250°F			10 min run
													Vost Tube set 2
	1558					93		3.0					0.5 L/min
	1603	6588.52				93		3.0					
	Δ=10	Δ=4.62				(Tavg) = 93°F							
	min	dry Liters											
												Tenax # T069	
												Tenax + Charcoal #	
												TC068	
													Estimates:
													MW = 29.2
													%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10	< 10
After	10	< 10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR JB
BAROMETRIC PRESSURE 29.28

TEST DATE 7-28-93 (Wed)
TEST NO. N-21-VOS-728-3
NOZZLE (SIZE,#) —
STATIC PRESSURE 0.8" H2O
PORT DIRECTION D

ORIFICE CORRECTION —
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION —
CONTROL BOX NO. Nutech #500304

HOT BOX NO. —
COLD BOX NO. —
PROBE NO. 7-2
FILTER NO. —
STACK DIA. 50' (bypk) x

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (liters)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments 97 Bulk
	1657	6596.33		500 cc/min		89		3.0		250F			30 min run
													VOST Tube #3
	1702					88		3.0					0.5 l/min
	1707					87		3.0					
	1712					86		3.0					
	1717					85		3.0					
												Tenax # TD34A	
	1722					85		3.0				Tenax and Charcoal #	
												TC034A	
	1727	6611.50				85		3.0					
	Δ=30	Δ=15.17											Estimates:
	min	dry liters											MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/(min)
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

N-18-VOS-723

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING
[redacted] SOURCE SAMPLING DATA SHEET

CLIENT DOE
TEST UNIT Bashaise SNOX
PROJECT NO. Niles
SYSTEM OPERATOR Kent Rennie
BAROMETRIC PRESSURE

TEST DATE 7/23/93
TEST NO. N-18-VOS-723
SITE NO. Inlet 18
STACK DIAMETER
PORT DIRECTION

DRY GAS METER NO.
METER CORRECTION (Y)
CALIBRATION DATE

~~Traverse Point~~ Sample Name (inches)	Clock Time	Dry Gas Meter Reading (dcf)	~~Back Reading~~ Flow rate (lit/min) ~~(ccfmin)~~	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	6 ~~Filter Box~~ Temp. Condenser °C ~~(°F)~~	~~Impinger~~ Temp. Ice Bath °C ~~(°F)~~	Probe Temp. (°F)	Comments
T015A	9:30	581.52		.3	~~[illegible]~~	3	360	14	2	87	
TC017A	9:32	582.36	.53	.3		3	364	16	2	94	
	9:35	583.97	.59	.3		3	366	16	2	102	
	End	585.02									
		RR									
T012A	9:55	585.~~[illegible]~~	.41	.3		3	363	14	2	147	
TC039A	10:00	588.00	.59	.3		3	362	13	3	155	
	10:05	590.58	.58	.3		3	357	12	3	169	
	End	591.46									
T008A	10:20	591.59	.52	.3		3	364	12	4	183	
TC005A	10:30	597.18	.49	.3		3	365	10	4	192	Estimates:
	10:40	602.65	RR ~~.60~~ .50	.3		3	367	9	3	200	MW=
End	10:50	608.95	.49	.3		3	366	12	4	198	%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate ~~(ccfmin)~~ (lit/min)	
Before	17	.015	1st run
After	16	.01	2nd run
	15	.01	3rd run

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2		
CO		
N2		

AQE 7/92

BMI
X-390 H
VOST 280/01B

5
10
30

goal = 0.5 l/min

RunPorte

Initial Vacuum check 5 in Hg — 8 sec/0.1 cuft

	Time	Gas Meter	Bath (°B)	Impinger (°C)	Vacuum (Hg)	Flow	
N19-VOS-723-1	0918	0515.28					5
5 min.	0918	0515.28	8	19	2.5	40	START
	0923	0518.58	8	19	2.5	39.5	Finish
		3.30 cuft					

Vacuum check 5 in Hg — 7 sec/0.1 cuft

	Time	Gas Meter	Bath	Impinger	Vacuum	Flow	
N19-VOS-723-2							
10 min.	0934	0518.80	8	20			
	0935	0518.80	8	20	2.0	40	START
	0940	0522.00	8	20	2.5	38.5	5 min
	0945	0524.24	8	20	2.5	38.0	10 min
		5.44 cuft					

Vacuum Check 240 sec/0.1 cuft.

	Time	Gas Meter	Bath	Impinger	Vacuum	Flow	
N-19-VOS-723-3							
30 min.	0953	0524.50	9	21	2.0	39.0	START
	1000	0528.00	8	21	2.0	39.5	
	1014	0535.00	9	22	3.0	37.0	
	1023	0540.50	9	23	3.2	39.5	Finish

N-19-VOS-723

STACK SAMPLING DATA SHEET

CLIENT Battelle/DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93X-028-01
CONTROL BOX OPERATOR MG
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-20-VOS-723-1
NOZZLE (SIZE,IN) Glass
STATIC PRESSURE 15.0" H_2O
PORT DIRECTION #6

ORIFICE CORRECTION ——
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION ——
CONTROL BOX NO. 06M-493-596555

HOT BOX NO. 3
COLD BOX NO. –
PROBE NO.
FILTER NO. —
STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading Dry liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Condensate Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	0935	28.560		500cc/min	546	68	68	1.0	680	~250F	<68F	~250F	VOST Tube #
	0940	31.462			564	68	68	1.0	677	265	40	245	5 min run
	Δ=5	Δ=2.902				(Tmeter avg)	= 68°F		(Tstack avg)	= 679°F			at 0.5L/min
	min	dry liters											
													T0 39A
											Tenax #	T039A	
											Tenax &	Charcoal	# TC041A
													Estimates:
													MW=29.2
													%H2O=9

LEAK CHECK (cc/min)

	in. Hg	Rate
Before	10.0	3.0
After	10.0	3.0

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C620-01
CONTROL BOX OPERATOR MG
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-20-VOS-723-2
NOZZLE (SIZE,#) Glass
STATIC PRESSURE 15.0" H2O
PORT DIRECTION #6

ORIFICE CORRECTION —
METER CORRECTION 0.9735
CALIBRATION DATE 06/14/93
PITOT CORRECTION —
CONTROL BOX NO. DGM-934586555

HOT BOX NO. 3
COLD BOX NO. —
PROBE NO.
FILTER NO. —
STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading Dry (liters)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	~~Impinger~~ condensate Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1005	34.762		500cc/min	553	69	69	1.0	673	~250°F	<68°F	~250°F	VOST Tube =
					537	69	69	1.0	677				
	1015	40.243			544	70	70	1.0	675	268	39	242	10 min run
													at 0.5 L/min
	Δ=10	Δ = 5.481				(T meter)avg = 69°F			(T stack)avg = 675°F				
	min	dry Liters											
											Tonas #TO30A		
											Tonas + Channel		#TC031A
													Estimates:
													MW=29.2
													%H2O=9

LEAK CHECK

	in. Hg	Rate (cc/min)
Before	10.0	5.0
After	10.0	2.0

PITOT LEAK CHECK

POS.	NEG.

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-23-93 (Fri.)	ORIFICE CORRECTION —	HOT BOX NO. 3
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-V05-723-3	METER CORRECTION 0.9735	COLD BOX NO. —
PROJECT NO. 93C028-01	NOZZLE (SIZE,I) Glass	CALIBRATION DATE 06/14/93	PROBE NO. —
CONTROL BOX OPERATOR MG	STATIC PRESSURE 17.0" H2O	PITOT CORRECTION —	FILTER NO. —
BAROMETRIC PRESSURE 29.38	PORT DIRECTION #6	CONTROL BOX NO. DGM-9345B6555	STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading Dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Condenser Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	1135	46.151		500 cc/min	534	73	73	1.0	680	~250°F	<68°F	~250°F	VOST Tube #
	1135				552	73	73	1.0	679				
					531	73	73	1.0	682	265	39	245	30-min run
					505	73	73	1.0	677				at 0.5 L/min
					550	73	73	2.0	675	265	40	247	
					545	73	73	2.0	678				
	1205	61.954			542	73	73	2.0	677	265	39	250	
	Δ=30	Δ=15.803				(Tmeter)avg	=73°F		(Tstack)avg	~678°F			
	min	dry liters											
											Trap #:		TD27A
											Tenax & charcoal #		TC048A
													Estimates:
													MW=29.2
													%H2O=9

LEAK CHECK cc/min

	in. Hg	Rate
Before	10.0	2.0
After	10.0	0.0

	1	2
CO2	14.0	
O2	7.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

KEYSTONE

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / Dutz	TEST DATE 7-23-93 (Fri)	ORIFICE CORRECTION —	HOT BOX NO.
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-V05-723-1	METER CORRECTION 0.9993	COLD BOX NO.
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 4-23-93	PROBE NO. 7-2
CONTROL BOX OPERATOR	STATIC PRESSURE 0.7"H2O	PITOT CORRECTION —	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION D	CONTROL BOX NO. Nutech #500304	STACK DIA. 50" (depth) X 99

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry (Liters)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger condenser Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
										~250°F	<68°F	~85°F	Vost tube #1
	~~[illegible]~~	~~[illegible]~~		500 cc/min	–								
	0947	1681.85				77		4.0					
													5 min run
	0952	1684.35				79		4.0					at 0.5 L/min
	Δ=5 min	Δ=2.50 dry Liters				(Tavg) = 78°F							
												Tenax # TØ28A	
												Tenax & Charcoal # TCØ16A	
													Estimates:
													MW = 29.2
													%H2O = 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate, cc/(min)
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Battelle / DOE	TEST DATE 7-23-93 (Fri.)	ORIFICE CORRECTION —	HOT BOX NO.
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-VOS-723-2	METER CORRECTION 0.9993	COLD BOX NO.
PROJECT NO. 93C[illegible]-01	NOZZLE (SIZE,in)	CALIBRATION DATE 4/2/93	PROBE NO. 7-2
CONTROL BOX OPERATOR JPD	STATIC PRESSURE 0.7" H2O	PITOT CORRECTION —	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION D	CONTROL BOX NO. [illegible]	STACK DIA. 58" (depth) K9

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	[illegible] (°F)	Hot Box Temp. (°F)	Comments
				300cc/min						[illegible]	~260°F	~250°F	Vost Tube #
	1014	6690.19				84		4.0		[illegible]			
													10 min run
	1019	[illegible]				85		4.0					at 0.5 L/min
	1024	6695.95				86		4.0					
	Δ=10 min	Δ=5.76 dry Liters				(T avg)me = 85°F							
												Tenax # TD434	
												Tenax & Charcoal #	
												TC019A	
													Estimates:
													MWd: 29.92
													%H2O- 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/min
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQB 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93CØ28-Ø
CONTROL BOX OPERATOR JPS
BAROMETRIC PRESSURE 29.38

TEST DATE 7-23-93 (Fri.)
TEST NO. N-21-VOS-723-3
NOZZLE (SIZE,#) —
STATIC PRESSURE 0.7" H2O
PORT DIRECTION B

ORIFICE CORRECTION —
METER CORRECTION 0.9993
CALIBRATION DATE 4-23-93
PITOT CORRECTION —
CONTROL BOX NO. Nutech #5020W

HOT BOX NO.
COLD BOX NO.
PROBE NO. 7-2
FILTER NO.
STACK DIA. 60" (high) X

Traverse Point (inches)	Time	Dry Gas Meter Reading Dry ([redacted])/Liters	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Condensate Temp. (°C/°F)	Hot Box Temp. (°F)	Comments (wich)
										~250°F	48°F	~250°F	VOST Tube #2
				500 cc/min									
	1140	6708.73				81		4.0					
													30-min run
	1145					83		3.0					at 0.5 l/min
	1150					83		3.0					
	1155					83		3.0					
	1200					83		3.0					
	1205					83		3.0				Tenax #	TØ4ØA
												Tenax+Charcoal #	
	1210	6724.52				84		3.0				TCØ22A	
													Estimates:
	Δ=30	Δ=15.79				(Tmeter)AVG = 83°F							MW=29.2
	min	dry Liters											%H2O=8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate cc/([redacted])min
Before	10	<10
After	10	<10

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	5.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

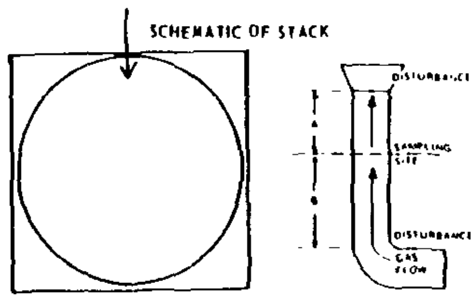
AQE 2/92

D-8: HEST Samples

PARTICULATE FIELD DATA N-18-H-719

Ve

SCHEMATIC OF STACK



CROSS SECTION

HEST BH IN

PLANT Niles
DATE 7-19
LOCATION BH IN HEST
OPERATOR Webb / Cox
STACK NO
RUN NO. 1 HEST
SAMPLE BOX NO
METER BOX NO

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE 28.95
ASSUMED MOISTURE, %
PROBE LENGTH, in 9' 108"
NOZZLE DIAMETER, in. —
STACK DIAMETER, in 80
PROBE HEATER SETTING 250 F
HEATER BOX SETTING 250 F

METER ΔH@ —
C FACTOR —
PROCESS WEIGHT RATE —

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	Time ~~STATIC PRESSURE (in H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in Hg gauge	Probe ~~VELOCITY~~ fps
	0	15:48					422.9			201			266
		16:03					430.3						
		16:10					437.5			211			203
		16:44					465.7			130 ?	Power failed?		183.5
		16:55					474.0			195			287.
		17:18					490.7			302			~~309~~
		17:33					500.0	102	100	275			282
		17:45					510.1	102	100	287			
		18:17					527.9			295			
		18:27					536.2						
		18:46					548.8						
		18:62	Stop				551.6	101	99	298			283
							-421.9						
							128.78 ft³						
TOTAL													
AVERAGE													

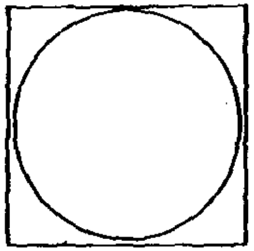
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

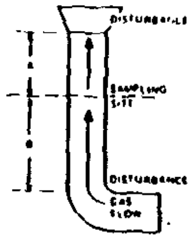
COMMENTS

PARTICULATE ELD DATA

SCHEMATIC OF STACK



CROSS SECTION



PLANT niles, Ohio SNOX process
DATE 7/19/93
LOCATION outlet of bag house
OPERATOR Lemark
STACK NO
RUN NO. N-19-HST-719
SAMPLE BOX NO.
METER BOX NO

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
PROBE LENGTH, in. 5ft S.S.
NOZZLE DIAMETER, in. 0.180
STACK DIAMETER, in.
PROBE HEATER SETTING
HEATER BOX SETTING 250°F

METER ΔH@
C FACTOR
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	meter serial # 1037662 GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCI fps
	~~0/16:32~~						~~178.623~~						
	0/16:43		381				183.772			289			
	10/16:53		382				194.3			273			
	20/17:03		382				203.4			256			
	30/17:13		382				213.3			248			
	40/17:23		382				223.5			242			
	80/18:03		382				265.7			261			
	110/18:33		381				290.2			255			
	160/19:23		381				329.5			263			
	186/19:48	off					360.473						
							− 183.772						
							176.701						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING
STACK SAMPLING DATA SHEET

CLIENT Batelle / DOE ..	TEST DATE 7-19-93 (Mon)	ORIFICE CORRECTION ($\Delta H@$) 2.002	HOT/COLD BOX NO. 1
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-~~[illegible]~~-719	METER CORRECTION (Y) 0.9812	PROBE NO. 13-2
PROJECT NO. 93C628-01	NOZZLE (SIZE,#) 0.441"	CALIBRATION DATE 06-08-93	FILTER NO. ~~[illegible]~~ 4"
TEST CREW RPC	STATIC PRESSURE 17.0" H_2O	PITOT CORRECTION 0.84	STACK DIA.
BAROMETRIC PRESSURE 29.30	PORT DIRECTION Vert	CONTROL BOX NO. 5.K	PORT SIZE 3c.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
	18:17	160.255	~~[illegible]~~	1.03	1.03	92	92	5.0	656	~250°F	48°F	~250°F	240 min./point
				1.50	1.50	105	91	9.0	650				Single Point
10				1.50	1.50	109	92	9.0	636				Non Isokinetic
				1.50	1.50	114	96	9.5	651				Sampling for
				1.50	1.50	117	99	10.5	651				X Toxics
				1.50	1.50	117	99	10.5	635				3 HR as per Battelle
				1.50	1.50	117	98	11.0	629				Readings every
				1.50	1.50	115	100	11.5	626				10 minutes
				1.50	1.50	115	98	11.5	624				
				1.50	1.50	115	100	11.5	636				Filter #93Q2843
				1.50	1.50	116	100	11.5	639				# 93H54
				1.50	1.50	116	100	11.5	640				# 93H55
				1.50	1.50	116	99	11.5	641				
				1.50	1.50	116	99	12.0	630				
				1.50	1.50	114	98	12.0	629				
				1.50	1.50	113	98	12.0	629				Estimates:
				1.50	1.50	112	97	12.0	620				MW= 29.2
	21:17	285.116		1.50	1.50	112	97	12.0	609				%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.015 cfm.
After	13.0	<0.015 cfm.

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2	13.0	13.0
O2	6.0	6.0
CO	0	0
N2	81.0	81.0

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100mL D.I. H_2O	725.0	548.8	176.2
2.	100mL D.I. H_2O	489.9	462.9	27.0
3.	Empty	439.3	435.9	3.4
4.	200g Silica Gel	687.2	660.0	27.2
5.				

233.8 g tot

AQE 6/92

0 0 0 0 0 0
76 5 4 3 2 1
10"
FLOW ↓

TIME = 180 min
Volume = 124.861 dcf
(ΔH)avg = 1.47
(Tmeter)avg = 105°F
(Tstack)avg = 635°F

Actual Moisture = 9.1

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-19-93 (Mon)	ORIFICE CORRECTION	1.802	HOT BOX NO.	2
TEST UNIT	Snow Tower outlet	TEST NO.	N-21 · H2O · 719	METER CORRECTION	0.9619	COLD BOX NO.	2
PROJECT NO.	290028.01	NOZZLE (SIZE,#)	IN-Stack	CALIBRATION DATE	5-17-93	PROBE NO.	10.1
CONTROL BOX OPERATOR	TM	STATIC PRESSURE	-0.35" H2O	PITOT CORRECTION	0.84	FILTER NO.	[illegible]
BAROMETRIC PRESSURE	29.10	PORT DIRECTION	A	CONTROL BOX NO.	7	STACK DIA.	72" North

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	17:55	780.500	1.25	1.30	1.30	98	90	20.0	202	~250°F	<68°F	~250°F	240 min/pt
	01		1.30	1.20	1.20	100	92	20.0	202				Single pt.
	13		1.30	1.15	1.15	110	96	20.0	202				Max Tmp
	23		1.30	1.15	1.15	110	96	20.0	202				Temp Fil.
	35		1.30	1.15	1.15	110	96	20.0	202				3 Hrs
	45		1.25	1.30	1.30	110	96	20.0	202				
	18:55		1.30	1.30	1.30	111	98	20.0	202				10 min
	05		1.30	1.30	1.30	114	98	20.0	202				readings
	15		1.30	1.40	1.40	114	100	19.5	202				
	25		1.30	1.60	1.60	115	100	19.5	202				Filter #93027
	35		1.25	1.70	1.70	115	108	19.5	202				#93M260
	45		1.25	1.75	1.75	115	100	19.0	202				#93M261
	19:55		1.25	1.50	1.50	120	100	15.0	202				
	05		1.30	1.50	1.50	125	100	14.0	202				
	15		1.30	1.50	1.50	125	102	13.0	202				Estimates:
	25		1.25	1.50	1.50	125	102	12.5	202				MW= 29.2
	35		1.30	1.50	1.50	126	102	11.5	202				%H2O= 8.5
	45	912.680	1.30	1.50	1.50	126	102	11.0	202				

SYSTEM LEAK CHECK 9.55

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.08
After	20.0	<0.16

PITOT LEAK CHECK OK

	Positive	Negative
Before	OK	OK
After	OK	OK

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

(Tstack)avg = 202°F

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL DI	665.0	547.5	117.5
2.	100 mL DI	573.1	537.4	35.7
3.	empty	465.6	444.7	20.9
4.	silica gel	676.0	640.3	35.7
5.				

209.8 g total

TIME = 180 min

VOLUME = 131.180 dcf

$(\Delta P)_{avg}$ = 1.30

velocity = 72.2 ft/sec

AQE 2/92

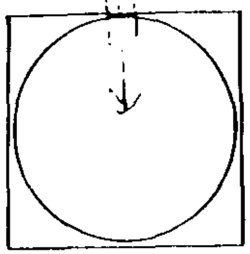
KEYSTONE

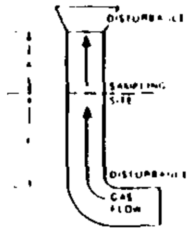
HEST

PARTICULATE FIELD DATA

IV-18-H-722

SCHEMATIC OF STACK





CROSS SECTION

HEST

PLANT ______

DATE 7-22-73

LOCATION BH IN #18

OPERATOR Webb

STACK NO ______

RUN NO 2 HEST (Vert)

SAMPLE BOX NO —

METER BOX NO —

AMBIENT TEMPERATURE 80

BAROMETRIC PRESSURE 27.20

ASSUMED MOISTURE, % —

PROBE LENGTH, in. ______

NOZZLE DIAMETER, in —

STACK DIAMETER, in. 80

PROBE HEATER SETTING 250

HEATER BOX SETTING 250

METER $\Delta H_@$ —

C FACTOR —

PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	~~STATIC PRESSURE (in H₂O)~~ Time	STACK TEMPERATURE (T_S), °F	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in Hg gauge	Prol VELOCITY
	0	13:04					551.465						
			398-400				~~450.54~~						
		13:45	|				580.90	96	83	287			326
		14:30	V				609.5	95	54	285			324
		14:51				Vacuum	626.7	99	54	280			316
		15:10		[illegible] gage			640.6					5	
		15:30					656.9	113	87	256		10	307
		15:42					665.9	114	88	242		12	303
		16:10	Stop				690.10						
							-551.465						
							138.635						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

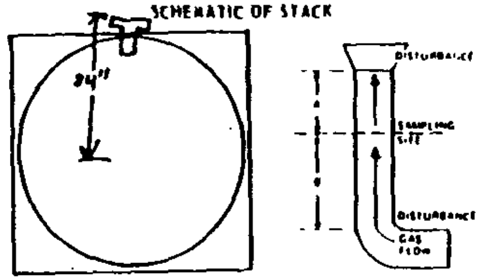
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS ~~Pitot "change" [illegible]~~
~~Imp drained~~
~~Leak check at 12" Hg = .02 cfm~~
Leak check at 10"Hg = .065 cfm

127 ca. ft.

PARTICULATE 'ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT niles, Ohio SNOX process

DATE 7/22/93

LOCATION outlet of baghouse

OPERATOR Leonard

STACK NO. N-19-HST-722

RUN NO. ______

SAMPLE BOX NO ______

METER BOX NO. ______

AMBIENT TEMPERATURE 79

BAROMETRIC PRESSURE 29.20

ASSUMED MOISTURE, % 7

PROBE LENGTH, in. ______

NOZZLE DIAMETER, in. 0.180

STACK DIAMETER, in. ______

PROBE HEATER SETTING ______

HEATER BOX SETTING 250°F

METER ΔH@ ______

C FACTOR ______

PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WA
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	~~STATIC PRESSURE~~ probe temp. (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	meter # 1037662 GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
	0/13:57	on	383				543.164			227		15.0	
	10/14:07		382				550.6			251		15.0	
	30/14:27	263	381				566.6	83	80	281		15.0	
	60/14:57	278	384				587.4	96	81	279		15.0	
	90/15:27	271	384				609.2	89	84	269		15.0	
	120/15:57	279	384				631.4	89	84	257		15.0	
	135/16:12	294	385				642.4	92	85	274		15.0	
	160/16:37	251	384				660.8	95	87	275		15.0	
	180/16:57	off					675.688						
							−543.164						
							132.524						
TOTAL													
AVERAGE													

leak check 0.07 cfm at 15" Hg

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

STACK SAMPLING DATA SHEET

Page 1 of

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C628-01
CONTROL BOX OPERATOR RPC
BAROMETRIC PRESSURE 29.37

TEST DATE 7-22-93 (Thurs.)
TEST NO. N-20-H-722
NOZZLE (SIZE,#) 0.495"
STATIC PRESSURE -1.70" H_2O
PORT DIRECTION Port #2

ORIFICE CORRECTION ~~1.002~~ 2.002
METER CORRECTION ~~1.002~~ 0.982
CALIBRATION DATE ~~[illegible]~~ 6-9-93
PITOT CORRECTION 0.84
CONTROL BOX NO. SIX

HOT BOX NO. #2
COLD BOX NO. #2
PROBE NO. 13-2
FILTER NO.
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	1510	425.225		2.00	2.00	85	85	9.0	681	~250°F	<68°F	~250°F	
				2.00	2.00	105	87	10.0	686				Single Point
				2.00	2.00	111	90	10.5	696				Non-Isokinetic
				2.00	2.00	115	91	11.5	689				Sampling for
				2.06	2.00	116	96	11.5	689				4 hours
	1610			2.00	2.00	118	97	11.5	690				
				2.00	2.06	115	99	12.0	691				Target ΔH =
				2.00	2.00	117	99	12.5	697				1.5
				2.00	2.00	116	99	12.5	698				
				2.00	2.00	117	99	12.5	700				Readings every
				2.00	2.00	115	100	12.5	700				10 min
	1710			2.00	2.00	117	99	13.0	701				
				2.00	2.00	115	100	13.0	701			Filter # 93-028[illegible]	
				2.00	2.00	115	99	13.0	701			# 93-[illegible]	
				2.00	2.00	115	100	13.0	698			# 93-[illegible]	
				2.00	2.00	117	100	13.0	696				
				2.00	2.00	117	100	13.0	696				
				2.00	2.00	119	100	13.0	671				

Estimates:
MW = 29.2
%H2O = 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.015 cfm
After	14.0	<0.020 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml DI H_2O	709.2	517.4	191.8
2.	100 ml DI H_2O	607.2	542.4	64.8
3.	Empty	455.1	444.3	10.8
4.	200 g Silica Gel	678.4	632.2	46.2
5.				

313.6 g total

0 0 0 0 0 0
0 0 4 3 3 1

FLOW

AQE 2/93

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93602B-01
CONTROL BOX OPERATOR RDC
BAROMETRIC PRESSURE 29.38

TEST DATE 7-21-93 (Thurs.)
TEST NO. N-20-H-722
NOZZLE (SIZE, #) 0.485
STATIC PRESSURE 17.0 "H2O
PORT DIRECTION Port #2

ORIFICE CORRECTION 2.002
METER CORRECTION 0.9812
CALIBRATION DATE 06-09-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Six

HOT BOX NO. #2
COLD BOX NO. #2
PROBE NO. 15-2
FILTER NO.
STACK DIA.

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H20)	Orifice ΔH Act. (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90"	1810			2.00	2.00	115	98	12.0	650	~250°F	68°F	~250°F	Single Point
				2.00	2.00	115	99	13.0	633				Non Isokinetic
				2.00	2.00	115	98	13.0	639				Sampling for
				2.00	2.00	114	97	13.0	633				4 hours
				2.00	2.00	114	97	13.0	637				
	19:10	620.794		2.00	2.00	114	97	13.0	635				Target ΔH =
													1.5
	Δ=	Δ=195.569		(ΔH)avg = 2.00		(Tmeter)avg = 108°F			(Tstack)avg = 639°F				
	240min	dcf											
													Readings every
													10 min
												Filter #	93-Q284[redacted]
												#	93-[redacted]H4
												#	93-[redacted]H44
													Estimates:
													MW= 29.2
													%H2O= 9

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	14.0	
O2	6.0	
CO	0	
N2	80.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

AQE 2/92

KEYSTONE

STACK SAMPLING DATA SHEET

CLIENT	Battelle / DOE	TEST DATE	7-22-93 (Thurs.)	ORIFICE CORRECTION	1.802	HOT BOX NO.	1
TEST UNIT	SNOX Baghouse Outlet	TEST NO.	N-21-H-722	METER CORRECTION	0.9619	COLD BOX NO.	1
PROJECT NO.	93C828-01	NOZZLE (SIZE,#)	—	CALIBRATION DATE	5-12-93	PROBE NO.	10-1
CONTROL BOX OPERATOR	TM	STATIC PRESSURE	8.10" H2O	PITOT CORRECTION	0.84	FILTER NO.	
BAROMETRIC PRESSURE	29.38	PORT DIRECTION	B	CONTROL BOX NO.	7	STACK DIA.	58' (depth) X 99' (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	15:10	041 360	0.90	1.5	1.5	110	98	9.5	200	~250°F	268°F	~250°F	Single Point
	↓		0.95	1.5	1.5	118	96	10.0	200				Non Isokinetic
			0.95	1.5	1.5	120	96	10.0	200				Sampling for
			0.95	1.5	1.5	120	96	10.0	200				4 hours
			0.95	1.5	1.5	120	96	10.0	200				
			0.95	1.5	1.5	120	96	10.0	200				Readings every
	16:10		0.90	1.5	1.5	121	98	10.0	200				10 minutes
	↓		0.90	1.5	1.5	121	98	10.0	200				
			0.90	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				
			0.95	1.5	1.5	121	98	10.0	200				Filter #93-Q2847
	17:10		0.90	1.5	1.5	121	98	10.0	200				# 93-H45
	↓		0.90	1.5	1.5	121	98	10.0	200				# 93-H46
			0.90	1.5	1.5	121	98	10.0	200				Estimates:
			0.95	1.5	1.5	121	98	10.0	200				MW= 29.2
			0.95	1.5	1.5	121	98	10.0	200				%H2O= 8.5
			0.90	1.5	1.5	121	98	10.0	200				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.009
After	10.5	0.012

PITOT LEAK CHECK 15 sec.

	Positive	Negative
Before	ok	ok
After	ok	ok

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml DI H2O	751.2	542.2	209.0
2.	100 ml DI H2O	513.5	475.6	37.9
3.	Empty	442.5	435.5	7.0
4.	222 g Silica Gel	700.7	659.7	41.0
5.				

Actual Moisture = 8.2%

294.9 g total

KEYSTONE

AQE 2/92

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-22-93 (Thurs.)	ORIFICE CORRECTION 1.602	HOT BOX NO. 1
TEST UNIT SNOX Tower Outlet	TEST NO. N-21-H-722	METER CORRECTION 0.9618	COLD BOX NO. 1
PROJECT NO. 93C028-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 5-12-93	PROBE NO. 10-1
CONTROL BOX OPERATOR TM	STATIC PRESSURE -2.10" H2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.38	PORT DIRECTION B	CONTROL BOX NO. 7	STACK DIA. 50" (depth) x 97" (width)

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	18:10		0.90	1.5	1.5	118	96	10.5	200	~250°F	48°F	~250°F	Single Point
			0.95	1.5	1.5	118	97	10.5	200				Non-Isokinetic
			0.95	1.5	1.5	116	94	10.5	200				Sampling for
			0.55	1.5	1.5	114	93	10.5	200				4 hours
			0.90	1.5	1.5	114	90	10.5	200				
			0.90	1.5	1.5	112	90	10.5	200				Readings every
	19:10	218.572											10 minutes
	Δ=240 min	Δ=177.512 dcf	$(\Delta P)_{avg}$ = 0.95		$(\Delta H)_{avg}$ = 1.5	$(T_{meter})_{avg}$ =		07°F	$(T_{stack})_{avg}$ = 200°F				
								velocity = 61.4 ft/sec				Filter	#93-02817
													#93-H45
		0.66 dscfm											#93-H46
													Estimates:
													MW= 29.2
													%H2O= 8.5

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before		
After		

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	13.0	
O2	6.0	
CO	0	
N2	81.0	

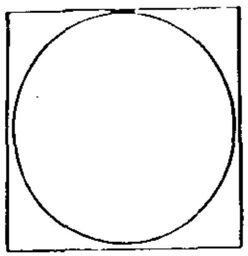
Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

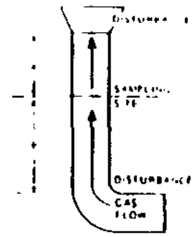
AQE 2/92

Gas Meter
SN, 36710

SCHEMATIC OF STA[illegible]



CROSS SECTION



PARTICULATE FIELD DATA

N-18-H-724

PLANT Niles
DATE 7-24-93
LOCATION BH IN 18
OPERATOR Webb
STACK NO —
RUN NO 3 HEST
SAMPLE BOX NO —
METER BOX NO —

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE 27.14
ASSUMED MOISTURE, % —
PROBE LENGTH, in. 108
NOZZLE DIAMETER, in —
STACK DIAMETER, in. 80
PROBE HEATER SETTING ≥ 250
HEATER BOX SETTING ≥ 250

METER $\Delta H_@$ —
C FACTOR —
PROCESS WEIGHT RATE —

WEIGHT OF PARTICULATE COLLECTED, m		
SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

HEST

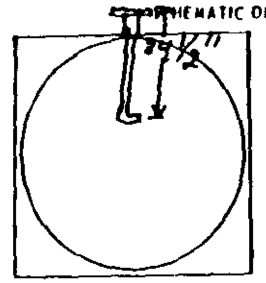
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	~~STATIC PRESSURE (in. H_2O)~~ Time	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) O2	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Prot ~~VELOCITY~~
Start	0	12:25		3.0			691.83						
	1:15(75)	13:40	~380				757.2	96	86	280		12	313
	105	14:10		3.2			769.5	96	87	283		13	314
	123	14:28		3.0			780.7	96	87			13	
	133	14:38					787.1					19	
	158	15:03					802.0	100	88	313		19	336
	177	15:22		2.8			813.6	98	87	288		19½	278
Stop		16:40					823.17						
							691.83						
							131.34						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

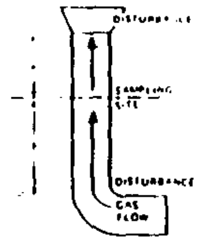
ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS: Pre Leak check .015 cf at 10" Hg
Post Leak Check .02 at 18" Hg

PARTICULATE FIELD DATA



CROSS SECTION



PLANT Niles, Ohio [illegible]
DATE 7/24/93
LOCATION outlet of bag house
OPERATOR [illegible]
STACK NO ______
RUN NO. N-19-HES-724
SAMPLE BOX NO. ______
METER NO C-10702

AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE ______
ASSUMED MOISTURE, % ______
PROBE LENGTH, in. ______
NOZZLE DIAMETER, in. ______
STACK DIAMETER, in. ______
PROBE HEATER SETTING ______
HEATER BOX SETTING ______

METER ΔH@ ______
C FACTOR ______
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED,		
SAMPLE	FILTER	PROBE W
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
	TOTAL	

TRAVERSE POINT NUMBER	SAMPLING TIME (Θ), min	probe temp °F ~~STATIC~~ PRESSURE ~~(in. H₂O)~~	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	meter # 1037662 GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELO
	0/14:06	on	380				848.200	.					
	10/14:15	269	382				855.3	92	86	235		15.0	
	25/14:20	309	382				865.9	98	90	248		15.0	
	60/15:05	271	383				890.5	101	94	286		15.0	
	90/15:26	299	383				911.9	97	93	280		15.0	
	120/16:25	253	383				933.7	101	96	280		15.0	
	160/16:45	267	384				962.0	102	96	269		15.0	
	180/17:05	off					976.427						
							848.200						
							128.227						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS
leak rate before 0.07 cfm at 22" Hg
leak rate after 0.072 cfm at 22" Hg

STACK SAMPLING DATA SHEET

CLIENT Battelle /DOE	TEST DATE 7-21-93 (Sat.)	ORIFICE CORRECTION 1.975	HOT BOX NO. #2
TEST UNIT SCR Reactor Outlet	TEST NO. N-20-H-724	METER CORRECTION 0.9924	COLD BOX NO.
PROJECT NO. 93C0228-01	NOZZLE (SIZE,#) 0.485	CALIBRATION DATE 07-16-93	PROBE NO. 13-1
CONTROL BOX OPERATOR RPC	STATIC PRESSURE 16.0" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION Port #3	CONTROL BOX NO. Partners Bio	STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
90	1425	759.715		1.40	1.40	93	83	9.0	651	~250°F	68°F	~250°F	Single Po
				1.40	1.40	101	93	9.5	656				Non Test,
				1.50	1.50	107	87	10.0	659				Sampling f
				1.50	1.50	115	95	10.0	659				4 hours
				1.50	1.50	116	95	10.0	659				
				1.50	1.50	117	95	10.0	666				Target ΔH:
				1.50	1.50	115	96	10.0	650				
				1.50	1.50	118	97	10.0	655				Reading on
				1.50	1.50	118	98	10.0	656				Nomo
				1.50	1.50	119	100	10.0	659				
				1.50	1.50	117	99	10.0	656				
				1.50	1.50	120	99	10.0	655			Filter	# Quartz
				1.50	1.50	116	100	10.0	656				#93-H62
				1.50	1.50	120	101	10.0	659				#93-H63
				1.50	1.50	120	101	10.0	660				Estimates:
				1.50	1.50	120	100	10.0	651				MW= 29.2
				1.50	1.50	120	100	10.0	655				%H2O= 9

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	<0.005 cfm
After	11.0	<0.02 cfm

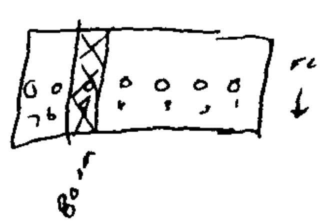
	1	2
CO2	13.5	13.5
O2	6.0	6.0
CO	0	0
N2	80.5	80.5

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml D.I. H_2O	736.1	544.4	191.7
2.	100ml D.I. H_2O	477.3	446.0	31.3
3.	Empty	441.6	435.4	6.2
4.	Silica Gel	697.6	661.5	36.1
5.				

265.3g total

PITOT LEAK CHECK

POS.	NEG.
ok / 15 sec	ok / 15 sec



KEYSTONE

KTL c of c

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SCR Reactor Outlet
PROJECT NO. 93C 929-61
CONTROL BOX OPERATOR LL
BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)
TEST NO. N-20-H-724
NOZZLE (SIZE,#) 0.485
STATIC PRESSURE 16.0 " H2O
PORT DIRECTION Port # 3

ORIFICE CORRECTION 1.875
METER CORRECTION 0.9921
CALIBRATION DATE 7-4-93
PITOT CORRECTION 0.84
CONTROL BOX NO. Acurex-1 Gr. #1

HOT BOX NO. = 2
COLD BOX NO. = 2
PROBE NO. 13-1
FILTER NO.
STACK DIA.

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
				1.50	1.50	122	102	10.0	661	~250°F	68°F	~250°F	Single Point
				1.50	1.50	118	101	10.0	659				Non-Isokinetic
				1.50	1.50	121	113	10.0	660				Sampling for
				1.50	1.50	121	113	10.0	658				4 hours
				1.50	1.50	121	115	10.0	655				
				1.50	1.50	123	115	10.0	652				Target ΔH
	1825	1121.350		1.50	1.50	124	105	10.0	656				
													Readings every
													10 min
	Δ=240 min	Δ=161.635 dcf		$(\Delta H)_{avg}$	= 1.50	$(T_{meter})_{avg}$	= 108°F		$(T_{stack})_{avg}$	= 657°F			
												Filter	# Quartz
													# 93H62
													# 93H63
													Estimates:
													MW=29.2
													%H2O=9

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After		

	1	2
CO2	13.5	
O2	6.0	
CO	0	
N2	80.5	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

PITOT LEAK CHECK

POS.	NEG.

KEYSTONE

Page 1 of 2

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE	TEST DATE 7-24-93 (Sat)	ORIFICE CORRECTION 1.673	HOT BOX NO. 1
TEST UNIT SNOX Tower Outlet	TEST NO. N-24-H-724	METER CORRECTION 0.9912	COLD BOX NO. 1
PROJECT NO. 93C0248-03	NOZZLE (SIZE, in) —	CALIBRATION DATE 5-19-93	PROBE NO. 7-2
CONTROL BOX OPERATOR TM	STATIC PRESSURE 8.5" H_2O	PITOT CORRECTION 0.84	FILTER NO.
BAROMETRIC PRESSURE 29.35	PORT DIRECTION B	CONTROL BOX NO. 4	STACK DIA. 50" (Depth) × 97" (Width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
50"	14:15	588.810	1.0	1.5	1.5	90	80	7.0	200	~200°F	<68°F	~200°F	Single Point
			1.0	1.5	1.5	94	81	7.0	200				Non Isokinetic
			1.0	1.5	1.5	96	81	7.0	201				Sampling for
			1.0	1.5	1.5	102	83	7.0	200				4 hours
			1.0	1.5	1.5	106	84	7.0	200				
			1.0	1.5	1.5	112	85	7.0	202				Target ΔH=1.4
	15:15		1.0	1.5	1.5	118	87	7.0	204				
			1.0	1.5	1.5	118	87	7.0	204				Readings are
			1.0	1.5	1.5	122	87	7.0	205				10 minutes apart
			1.0	1.5	1.5	125	91	7.0	204				
			1.0	1.5	1.5	125	92	7.0	205				Filter # Quartz
			1.0	1.5	1.5	125	92	7.0	203				#93-1164
	16:15		1.0	1.5	1.5	125	92	7.0	202				#93-1165
			1.0	1.5	1.5	125	93	7.0	200				
			1.0	1.5	1.5	126	96	7.0	200				Estimates:
			1.0	1.5	1.5	126	95	7.0	200				MW= 29.2
			1.0	1.5	1.5	126	95	7.0	200				%H2O= 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before	5.0	<.02
After	7.0	<.02

PITOT LEAK CHECK 15 sec

POS.	NEG.
ok	ok

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml D.I. H_2O	714.7	519.8	194.9
2.	100ml D.I. H_2O	578.8	540.6	38.2
3.	Empty	453.5	444.8	8.7
4.	200g Silica Gel	676.3	641.0	35.3
5.				

277.1 g total

KEYSTONE

Actual Moisture = 8.0%

STACK SAMPLING DATA SHEET

CLIENT Battelle / DOE
TEST UNIT SNOX Tower Outlet
PROJECT NO. 93C028-01
CONTROL BOX OPERATOR TM
BAROMETRIC PRESSURE 29.35

TEST DATE 7-24-93 (Sat.)
TEST NO. N-21-H-724
NOZZLE (SIZE,#) —
STATIC PRESSURE 0.5 "H2O
PORT DIRECTION

ORIFICE CORRECTION 1.673
METER CORRECTION 0.9962
CALIBRATION DATE 5.19.93
PITOT CORRECTION 0.84
CONTROL BOX NO.

HOT BOX NO. 1
COLD BOX NO. 1
PROBE NO. 7-2
FILTER NO.
STACK DIA. 56" (depth) x 99" (width)

Traverse Point	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
			1.0	1.5	1.5	126	96	7.0	201	~250°F	<60°F	~250°F	Single Point
	17:15		1.0	1.5	1.5	126	96	7.0	201				Non Isokinetic
			1.0	1.5	1.5	125	95	7.0	200				Sampling for
			1.0	1.5	1.5	127	95	7.0	200				4 hours
			1.0	1.5	1.5	127	95	7.0	200				
			1.0	1.5	1.5	127	95	7.0	200				Target ΔH = 1.4
			1.0	1.5	1.5	127	95	7.0	201				
	18:15	754.831											Readings every
													10 minutes
	Δ=240 min	Δ=166.041		$(\Delta H)_{AVG}$ = 1.5		$(T_{meter})_{AVG}$ = 104°F		$(T_{stack})_{AVG}$	= 201°F			Filter #Quartz	
													#93-1464
							velocity =	63.0 ft/sec					#93-1465
													Estimates:
													MW = 29.2
													%H2O = 8.5

LEAK CHECK

	in. Hg	Rate (cfm)
Before		
After		

PITOT LEAK CHECK

POS.	NEG.

	1	2
CO2	13.0	
O2	8.0	
CO	0	
N2	79.0	

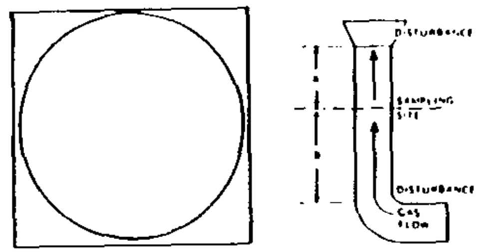
Impinger No.	Impinger Contents	Final	Initial	Difference
1.				
2.				
3.				
4.				
5.				

KEYSTONE

D-9: Cascade Impactors

PARTICULATE F[illegible]ELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT	Valco, Ohio stax proj[illegible]	AMBIENT TEMPERATURE	80°
DATE	July 19, 1993	BAROMETRIC PRESSURE	
LOCATION	outlet of baghouse	ASSUMED MOISTURE, %	7
OPERATOR	Leonard, Hugo	PROBE LENGTH, in.	
STACK NO	1	NOZZLE DIAMETER, in.	
RUN NO	N-19-IMP-719	STACK DIAMETER, in.	
SAMPLE BOX NO		PROBE HEATER SETTING	
METER BOX NO		HEATER BOX SETTING	

METER $\Delta H_@$ ______

C FACTOR ______

PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³ 0.6 cfm	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
	0 / 20:42		381					360.463						
	20/21:02		381					371.7						
	40/21:22		380					385.2						
	60/21:42		379					399.0						
	70/21:52		377					405.2						
	80/22:02		378					410.1						
	90/22:12		379					416.0						
	100/22:22		380					421.25						
	110/22:32		380					426.52						
	120/22:42	off						431.875						
								− 360.463						
								71.412						
TOTAL														
AVERAGE														

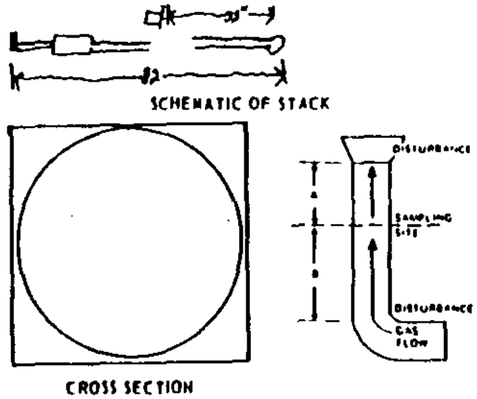
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

Page #4

PARTICULATE F LD DATA



PLANT niles, Ohio steel producers
DATE 7/21/93
LOCATION outlet of bag house
OPERATOR Leonard
STACK NO. ____
RUN NO. N-19-IMD-721
SAMPLE BOX NO. ____
METER BOX NO ____

AMBIENT TEMPERATURE ____
BAROMETRIC PRESSURE ____
ASSUMED MOISTURE, % ____
PROBE LENGTH, in. ____
NOZZLE DIAMETER, in. ____
STACK DIAMETER, in. ____
PROBE HEATER SETTING ____
HEATER BOX SETTING ____

METER ΔH@ ____
C FACTOR ____
PROCESS WEIGHT RATE ____

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft^3	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
	0 / 17:45		383					436.877						
	10 / 17:26		383					436.8						
	30 / 17:35		382					441.6						
	60 / 18:15		382					461.8						
	80 / 18:35		381					471.5	111.281					
	105 / 19:00		383					484.1						
	120 / 19:16		379					491.6						
	165 / 20:00		380					514.0						
	225 21:00 off		380					543.159						
	225 / 17:30 on 7/22/93		384					676.211	85	85	45.43		5.6	
	241 / 17:54		384					684.3	84	84			5.5	
	317 / 19:10 off							721.646						
	317 / 12:30 on 7/23/93		383					721.873						
TOTAL														
AVERAGE														

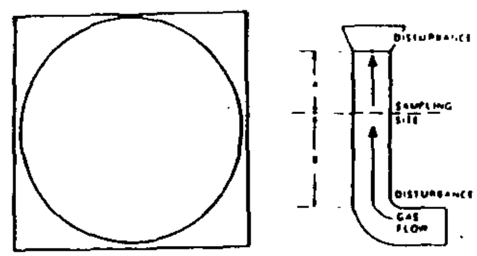
VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Niles, Ohio SNOX process
DATE 7/23/93
LOCATION outlet of baghouse
OPERATOR Lemark
STACK NO. ______
RUN NO. N-19-IMP-721
SAMPLE BOX NO. ______
METER BOX NO. ______

AMBIENT TEMPERATURE ______
BAROMETRIC PRESSURE ______
ASSUMED MOISTURE, % ______
PROBE LENGTH, in. ______
NOZZLE DIAMETER, in. ______
STACK DIAMETER, in. ______
PROBE HEATER SETTING ______
HEATER BOX SETTING ______

METER $\Delta H_@$ ______
C FACTOR ______
PROCESS WEIGHT RATE ______

WEIGHT OF PARTICULATE COLLECTED, mg		
SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY lps
	327/12:40		384				727.9	83	82			5.5	
	357/13:10		383				742.9	86	83			5.5	
	377/13:20		388				752.8	84	83	125.604		5.5	
	442/14:35		383				784.3	86	84			5.5	
	517/16:30						840.5						
	570/16:43	off 7/23/93					847.477						
	570/17:25	7/24/93					976.808						
	633/18:28						1006.4	89	88			5.5	
	680/19:25						1033.0			69.72			
	725/20:00	off					1046.528						
TOTAL													
AVERAGE													

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml 1	2	3	4	SILICA GEL WEIGHT, g
FINAL					
INITIAL					
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1					
2					
3					
4					

COMMENTS:

D-10: Calculations of Flue Gas Sampling Parameters and Particulate Matter Concentration

SNOX, BAGHOUSE INLET, LOCATION 18

	RUN NO.	1	2	3
	TEST DATE	7/18	7/19	7/21
	SAMPLING TIME, 24 HOUR CLOCK FROM	1010	1042	1323
	TO	2041	2030	2055
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.215	0.215
TT	NET TIME OF TEST, MIN.	384	384	384
PB	BAROMETRIC PRESSURE, IN. HG	29.60	28.95	29.17
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.50	1.20	1.00
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	256.1	245.5	227.7
TM	AVG. GAS METER TEMPERATURE, F	105	110	90
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	216.4	200.9	194.5
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	473.0	550.0	396.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	20.8	24.2	17.4
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.77	10.74	8.22
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.89	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	14.7	14.6	14.3
O2	STACK GAS O2, VOL PERCENT DRY	4.0	4.2	4.5
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.3	81.2	81.2
EA	STACK GAS EXCESS AIR, PERCENT	22.9	24.4	26.6
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	29.2	29.4
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	397	395	399
NP	NET SAMPLING POINTS	45	43	42

SNOX, BAGHOUSE INLET,LOCATION 18

		1	2	3
	RUN NO.	1	2	3
	TEST DATE	7/18	7/19	7/21
	SAMPLING TIME, 24 HOUR CLOCK FROM	1010	1042	1323
	TO	2041	2030	2055
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.47	-0.47	-0.47
PS	STACK GAS ABS. PRESSURE, IN. HG	29.13	28.48	28.70
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3798	3925	3909
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	64208	63612	65404
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	125959	130180	129644
I	ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	11764.7	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.902	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.441	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.967	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.472	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	491.59	0.00

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO.	1	2	3
TEST DATE	7/18	7/19	7/21
VOLUME OF GAS SAMPLED, NCF (DRY)	216.4	200.9	194.5
MOISTURE FRACTION VOLUME, PERCENT	8.8	10.7	8.2
AVERAGE STACK TEMPERATURE, F	397	395	399
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	64208	63612	65404
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	125959	130180	129644
ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
EXCESS AIR, PERCENT	22.9	24.4	26.6
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	11764.7	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.902	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.441	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.967	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.472	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	491.6	0.0

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE	1 7/18	2 7/19	3 7/21
VOLUME OF GAS SAMPLED, NCM	6.13	5.69	5.51
MOISTURE FRACTION VOLUME, PERCENT	8.8	10.7	8.2
AVERAGE STACK TEMPERATURE, C	202	201	203
STACK VOLUMETRIC FLOW RATE, NCMM	1818	1801	1852
STACK VOLUMETRIC FLOW RATE, CMM	3566	3686	3671
ISOKINETIC RATE, PERCENT	87.5	108.2	101.9
EXCESS AIR, PERCENT	22.9	24.4	26.6
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	11764.7	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	2063.5	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	1008.3	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	2211.8	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	1080.7	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	223.0	0.0

SNOX, BAGHOUSE INLET, LOCATION 18

			4	5	6
	RUN NO.		4	5	6
	TEST DATE		7/22	7/23	7/24
	SAMPLING TIME, 24 HOUR CLOCK	FROM	925	918	855
		TO	1709	1637	1646
DN	SAMPLING NOZZLE DIAMETER, IN.		0.215	0.215	0.215
TT	NET TIME OF TEST, MIN.		384	384	384
PB	BAROMETRIC PRESSURE, IN. HG		29.15	29.16	29.14
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O		1.50	1.20	1.20
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)		217.1	229.9	225.3
TM	AVG. GAS METER TEMPERATURE, F		115	110	110
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)		177.5	189.5	185.6
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML		409.0	324.0	412.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF		18.0	14.2	18.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT		9.20	6.99	8.89
MD	MOLECULAR FRACTION OF DRY GAS		0.91	0.93	0.91
CO2	STACK GAS C02, VOL PERCENT DRY		15.2	15.8	15.6
O2	STACK GAS O2, VOL PERCENT DRY		3.5	2.8	3.0
CO	STACK GAS CO, VOL PERCENT DRY		0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY		81.3	81.4	81.4
EA	STACK GAS EXCESS AIR, PERCENT		19.5	15.0	16.2
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS		30.6	30.6	30.6
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS		29.4	29.8	29.5
CP	PITOT TUBE COEFFICIENT		0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F		397	401	391
NP	NET SAMPLING POINTS		42	42	42

SNOX, BAGHOUSE INLET, LOCATION 18

	RUN NO.	4	5	6
	TEST DATE	7/22	7/23	7/24
	SAMPLING TIME, 24 HOUR CLOCK FROM	925	918	855
	TO	1709	1637	1646
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.47	-0.47	-0.47
PS	STACK GAS ABS. PRESSURE, IN. HG	28.68	28.69	28.67
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3765	3750	3688
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	62417	63397	61742
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	124883	124372	122325
I	ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	9879.6	0.0	11916.6
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.857	0.000	0.989
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.428	0.000	0.499
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.882	0.000	0.989
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.441	0.000	0.499
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	458.48	0.00	523.10

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO. TEST DATE	[illegible] 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	177.5	189.5	185.6
MOISTURE FRACTION VOLUME, PERCENT	9.2	7.0	8.9
AVERAGE STACK TEMPERATURE, F	397	401	391
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	62417	63397	61742
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	124883	124372	122325
ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
EXCESS AIR, PERCENT	19.5	15.0	16.2
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	9879.6	0.0	11916.6
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.857	0.000	0.989
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.428	0.000	0.499
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.882	0.000	0.989
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.441	0.000	0.499
PARTICULATE EMISSIONS, LB/HR	458.5	0.0	523.1

SNOX, BAGHOUSE INLET, LOCATION 18

RUN NO.	4	5	6
TEST DATE	7/22	7/23	7/24
VOLUME OF GAS SAMPLED, NCM	5.03	5.37	5.26
MOISTURE FRACTION VOLUME, PERCENT	9.2	7.0	8.9
AVERAGE STACK TEMPERATURE, C	202	205	199
STACK VOLUMETRIC FLOW RATE, NCMM	1767	1795	1748
STACK VOLUMETRIC FLOW RATE, CMM	3536	3521	3463
ISOKINETIC RATE, PERCENT	97.4	102.4	103.0
EXCESS AIR, PERCENT	19.5	15.0	16.2
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	9879.6	0.0	11916.6
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	1961.4	0.0	2262.3
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	980.3	0.0	1141.8
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	2017.8	0.0	2262.3
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	1008.4	0.0	1141.8
PARTICULATE EMISSIONS, KG/HR	208.0	0.0	237.3

SNOX, BAGHOUSE OUTLET, LOCATION 19

		1	2	3
	RUN NO.	1	2	3
	TEST DATE	7/18	7/19	7/21
	SAMPLING TIME, 24 HOUR CLOCK FROM	1020	958	1308
	TO	1810	1840	1925
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.247	0.247
TT	NET TIME OF TEST, MIN.	380	480	367
PB	BAROMETRIC PRESSURE, IN. HG	29.15	28.95	29.11
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.60	0.90	1.50
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	258.4	325.3	237.4
TM	AVG. GAS METER TEMPERATURE, F	95	97	102
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	221.8	273.1	201.0
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	490.0	715.0	411.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF	21.5	31.4	18.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.85	10.32	8.25
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.90	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	14.0	14.6	14.5
O2	STACK GAS O2, VOL PERCENT DRY	4.8	4.2	4.3
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.2	81.2	81.2
EA	STACK GAS EXCESS AIR, PERCENT	28.9	24.4	25.1
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.4	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.3	29.2	29.5
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	383	376	378
NP	NET SAMPLING POINTS	48	49	48

SNOX, BAGHOUSE OUTLET, LOCATION 19

	RUN NO.	1	2	3
	TEST DATE	7/18	7/19	7/21
	SAMPLING TIME, 24 HOUR CLOCK FROM	1020	958	1308
	TO	1810	1840	1925
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.44	-0.44	-0.44
PS	STACK GAS ABS. PRESSURE, IN. HG	28.71	28.51	28.67
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3437	3428	3340
AS	STACK AREA, SQ. IN.	4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	58212	57145	57177
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	113996	113691	110768
I	ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	21.3	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.001	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.001	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.001	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.001	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	0.59	0.00

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO.	1	2	3
TEST DATE	7/18	7/19	7/21
VOLUME OF GAS SAMPLED, NCF (DRY)	221.8	273.1	201.0
MOISTURE FRACTION VOLUME, PERCENT	8.9	10.3	8.3
AVERAGE STACK TEMPERATURE, F	383	376	378
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	58212	57145	57177
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	113996	113691	110768
ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
EXCESS AIR, PERCENT	28.9	24.4	25.1
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	21.3	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.001	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.001	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.001	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.001	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.6	0.0

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO.	1	2	3
TEST DATE	7/18	7/19	7/21
VOLUME OF GAS SAMPLED, NCM	6.28	7.73	5.69
MOISTURE FRACTION VOLUME, PERCENT	8.9	10.3	8.3
AVERAGE STACK TEMPERATURE, C	195	191	192
STACK VOLUMETRIC FLOW RATE, NCMM	1648	1618	1619
STACK VOLUMETRIC FLOW RATE, CMM	3228	3219	3136
ISOKINETIC RATE, PERCENT	99.9	99.2	95.5
EXCESS AIR, PERCENT	28.9	24.4	25.1
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	21.3	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	2.7	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	1.4	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	2.9	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	1.5	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.3	0.0

SNOX, BAGHOUSE OUTLET, LOCATION 19

		4	5	6
	RUN NO.	4	5	6
	TEST DATE	7/22	7/23	7/24
	SAMPLING TIME, 24 HOUR CLOCK FROM	907	901	900
	TO	1750	1514	1702
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.247	0.247
TT	NET TIME OF TEST, MIN.	480	360	480
PB	BAROMETRIC PRESSURE, IN. HG	29.20	29.16	29.14
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.50	1.60	1.50
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	307.2	233.3	313.6
TM	AVG. GAS METER TEMPERATURE, F	100	100	105
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	261.8	196.6	261.6
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	613.0	331.0	606.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF	27.0	14.6	26.6
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	9.34	6.89	9.24
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.93	0.91
CO2	STACK GAS C02, VOL PERCENT DRY	14.7	14.7	14.3
O2	STACK GAS O2, VOL PERCENT DRY	4.0	4.0	4.5
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.3	81.3	81.2
EA	STACK GAS EXCESS AIR, PERCENT	22.9	22.9	26.6
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.3	29.7	29.3
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	380	381	380
NP	NET SAMPLING POINTS	47	48	50

SNOX, BAGHOUSE OUTLET, LOCATION 19

			4	5	6
	RUN NO.		4	5	6
	TEST DATE		7/22	7/23	7/24
	SAMPLING TIME, 24 HOUR CLOCK	FROM	907	901	900
		TO	1750	1514	1702
PST	STATIC PRESSURE OF STACK GAS, IN. HG.		-0.44	-0.44	-0.44
PS	STACK GAS ABS. PRESSURE, IN. HG		28.76	28.72	28.70
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM		3316	3288	3306
AS	STACK AREA, SQ. IN.		4776.	4776.	4776.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)		56136	56981	55895
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)		109977	109038	109649
I	ISOKINETIC RATE, PERCENT		96.8	95.5	97.2
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG		42.6	0.0	276.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)		0.003	0.000	0.016
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)		0.001	0.000	0.008
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)		0.003	0.000	0.018
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)		0.001	0.000	0.009
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR		1.21	0.00	7.78

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO. TEST DATE	4 7/22	5 7/23	6 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	261.8	196.6	261.6
MOISTURE FRACTION VOLUME, PERCENT	9.3	6.9	9.2
AVERAGE STACK TEMPERATURE, F	380	381	380
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	56136	56981	55895
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	109977	109038	109649
ISOKINETIC RATE, PERCENT	96.8	95.5	97.2
EXCESS AIR, PERCENT	22.9	22.9	26.6
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	42.6	0.0	276.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.003	0.000	0.016
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.001	0.000	0.008
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.003	0.000	0.018
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.001	0.000	0.009
PARTICULATE EMISSIONS, LB/HR	1.2	0.0	7.8

SNOX, BAGHOUSE OUTLET, LOCATION 19

RUN NO.	4	5	6
TEST DATE	7/22	7/23	7/24
VOLUME OF GAS SAMPLED, NCM	7.41	5.57	7.41
MOISTURE FRACTION VOLUME, PERCENT	9.3	6.9	9.2
AVERAGE STACK TEMPERATURE, C	193	193	193
STACK VOLUMETRIC FLOW RATE, NCMM	1589	1613	1582
STACK VOLUMETRIC FLOW RATE, CMM	3114	3087	3104
ISOKINETIC RATE, PERCENT	96.8	95.5	97.2
EXCESS AIR, PERCENT	22.9	22.9	26.6
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	42.6	0.0	276.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	5.7	0.0	37.2
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	2.9	0.0	18.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	6.1	0.0	40.6
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	3.1	0.0	20.7
PARTICULATE EMISSIONS, KG/HR	0.5	0.0	3.5

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

	RUN NO.	1	2	3
	TEST DATE	7/19	7/22	7/24
	SAMPLING TIME, 24 HOUR CLOCK FROM	1008	908	902
	TO	2040	1746	1736
DN	SAMPLING NOZZLE DIAMETER, IN.	0.441	0.440	0.441
TT	NET TIME OF TEST, MIN.	360	480	480
PB	BAROMETRIC PRESSURE, IN. HG	29.10	29.38	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	0.90	1.42	1.20
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	190.6	326.2	291.4
TM	AVG. GAS METER TEMPERATURE, F	105	108	107
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	164.2	282.7	252.5
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	420.4	629.2	543.9
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF	18.5	27.7	23.9
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	10.12	8.91	8.65
MD	MOLECULAR FRACTION OF DRY GAS	0.90	0.91	0.91
CO2	STACK GAS C02, VOL PERCENT DRY	13.0	13.0	13.0
O2	STACK GAS O2, VOL PERCENT DRY	6.0	6.0	6.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.0	81.0	81.0
EA	STACK GAS EXCESS AIR, PERCENT	39.0	39.0	39.0
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.3	30.3	30.3
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.1	29.2	29.3
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	656	664	664
NP	NET SAMPLING POINTS	72	95	96

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

			1	2	3
	RUN NO.		1	2	3
	TEST DATE		7/19	7/22	7/24
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1008	908	902
		TO	2040	1746	1736
PST	STATIC PRESSURE OF STACK GAS, IN. HG.		1.25	1.25	1.18
PS	STACK GAS ABS. PRESSURE, IN. HG		30.35	30.63	30.53
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM		1124	1408	1304
AS	STACK AREA, SQ. IN.		34560.	34560.	34560.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)		108361	137904	127759
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)		269641	337900	313065
I	ISOKINETIC RATE, PERCENT		95.3	97.1	93.2
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG		1356.1	1651.5	2140.4
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)		0.127	0.090	0.131
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)		0.051	0.037	0.053
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)		0.153	0.108	0.157
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)		0.061	0.044	0.064
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR		118.09	106.33	142.91

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

RUN NO.	1	2	3
TEST DATE	7/19	7/22	7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	164.2	282.7	252.5
MOISTURE FRACTION VOLUME, PERCENT	10.1	8.9	8.7
AVERAGE STACK TEMPERATURE, F	656	664	664
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	108361	137904	127759
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	269641	337900	313065
ISOKINETIC RATE; PERCENT	95.3	97.1	93.2
EXCESS AIR, PERCENT	39.0	39.0	39.0
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	1356.1	1651.5	2140.4
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.127	0.090	0.131
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.051	0.037	0.053
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.153	0.108	0.157
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.061	0.044	0.064
PARTICULATE EMISSIONS, LB/HR	118.1	106.3	142.9

SNOX, SCR OUTLET, LOCATION 20, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCM	4.65	8.01	7.15
MOISTURE FRACTION VOLUME, PERCENT	10.1	8.9	8.7
AVERAGE STACK TEMPERATURE, C	346	351	351
STACK VOLUMETRIC FLOW RATE, NCMM	3068	3905	3617
STACK VOLUMETRIC FLOW RATE, CMM	7635	9568	8865
ISOKINETIC RATE, PERCENT	95.3	97.1	93.2
EXCESS AIR, PERCENT	39.0	39.0	39.0
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	1356.1	1651.5	2140.4
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	291.0	205.9	298.7
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	116.9	84.0	121.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	349.6	247.3	358.8
PARTICULATE LOADING, MG/CM AT 3% 02 (WET)	140.5	100.9	146.4
PARTICULATE EMISSIONS, KG/HR	53.6	48.2	64.8

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

			1	2	3
	RUN NO.		1	2	3
	TEST DATE		7/18	7/21	7/23
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1030	1300	904
		TO	1940	19	1543
DN	SAMPLING NOZZLE DIAMETER, IN.		0.448	0.441	0.441
TT	NET TIME OF TEST, MIN.		360	360	360
PB	BAROMETRIC PRESSURE, IN. HG		29.30	29.28	29.38
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O		1.26	0.90	1.10
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)		217.6	198.2	205.1
TM	AVG. GAS METER TEMPERATURE, F		110	104	106
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)		187.3	172.2	178.2
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML		414.3	356.2	366.5
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF		18.2	15.7	16.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT		8.86	8.34	8.29
MD	MOLECULAR FRACTION OF DRY GAS		0.91	0.92	0.92
CO2	STACK GAS C02, VOL PERCENT DRY		13.0	12.5	12.1
O2	STACK GAS O2, VOL PERCENT DRY		6.0	6.5	7.0
CO	STACK GAS CO, VOL PERCENT DRY		0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY		81.0	81.0	80.9
EA	STACK GAS EXCESS AIR, PERCENT		39.0	43.7	48.8
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS		30.3	30.3	30.2
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS		29.2	29.2	29.2
CP	PITOT TUBE COEFFICIENT		0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F		668	663	558
NP	NET SAMPLING POINTS		4	4	4

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

	RUN NO.		1	2	3
	TEST DATE		7/18	7/21	7/23
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1030	1300	904
		TO	1940	19	1543
PST	STATIC PRESSURE OF STACK GAS, IN. HG.		1.25	1.25	1.10
PS	STACK GAS ABS. PRESSURE, IN. HG		30.55	30.53	30.48
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM		1402	1106	1263
AS	STACK AREA, SQ. IN.		34560.	34560.	35460.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)		136558	108771	140443
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)		336507	265429	311030
I	ISOKINETIC RATE, PERCENT		83.5	99.5	81.8
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG		0.0	0.0	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)		0.000	0.000	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)		0.000	0.000	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)		0.000	0.000	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)		0.000	0.000	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR		0.00	0.00	0.00

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCF (DRY)	187.3	172.2	178.2
MOISTURE FRACTION VOLUME, PERCENT	8.9	8.3	8.3
AVERAGE STACK TEMPERATURE, F	668	663	558
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	136558	108771	140443
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	336507	265429	311030
ISOKINETIC RATE, PERCENT	83.5	99.5	81.8
EXCESS AIR, PERCENT	39.0	43.7	48.8
PARTICULATE MASS - PROBE,CYC,FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.000	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.000	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.0	0.0

SNOX, SCR OUTLET, LOCATION 20, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCM	5.30	4.88	5.05
MOISTURE FRACTION VOLUME, PERCENT	8.9	8.3	8.3
AVERAGE STACK TEMPERATURE, C	353	350	292
STACK VOLUMETRIC FLOW RATE, NCMM	3866	3080	3976
STACK VOLUMETRIC FLOW RATE, CMM	9528	7516	8807
ISOKINETIC RATE, PERCENT	83.5	99.5	81.8
EXCESS AIR, PERCENT	39.0	43.7	48.8
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	0.0	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.0	0.0

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

	RUN NO	1	2	3
	TEST DATE	7/18	7/21	7/23
	SAMPLING TIME, 24 HOUR CLOCK FROM	1015	1300	904
	TO	1925	1934	1525
DN	SAMPLING NOZZLE DIAMETER, IN.	0.197	0.197	0.195
TT	NET TIME OF TEST, MIN.	357	364	364
PB	BAROMETRIC PRESSURE, IN. HG	29.30	29.28	29.38
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.18	1.29	1.24
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	228.9	233.3	241.1
TM	AVG. GAS METER TEMPERATURE, F	108	103	105
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	191.5	196.8	198.9
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	373.1	389.6	383.3
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF	16.4	17.1	16.9
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	7.89	8.01	7.81
MD	MOLECULAR FRACTION OF DRY GAS	0.92	0.92	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	13.8	12.1	13.8
O2	STACK GAS O2, VOL PERCENT DRY	5.0	7.0	5.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.2	80.9	81.2
EA	STACK GAS EXCESS AIR, PERCENT	30.4	48.7	30.4
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.4	30.2	30.4
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	29.2	29.4
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	197	197	199
NP	NET SAMPLING POINTS	4	4	4

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

	RUN NO.	1	2	3
	TEST DATE	7/18	7/21	7/23
	SAMPLING TIME, 24 HOUR CLOCK FROM	1015	1300	904
	TO	1925	1934	1525
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	0.07	0.06	0.05
PS	STACK GAS ABS. PRESSURE, IN. HG	29.37	29.34	29.43
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3753	3934	3838
AS	STACK AREA, SQ. IN.	4032.	4032.	4032.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	71179	74443	72790
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	105081	110150	107473
I	ISOKINETIC RATE, PERCENT	99.7	96.1	101.3
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG	0.0	0.0	0.0
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.000	0.000	0.000
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.000	0.000
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR	0.00	0.00	0.00

SNOX, CONDENSER

RUN NO.
TEST DATE

VOLUME OF GAS SA

MOISTURE FRACTIO

AVERAGE STACK TE

STACK VOLUMETRIC

STACK VOLUMETRIC

ISOKINETIC RATE,

EXCESS AIR, PERC

SNOX, CONDENSER OUTLET, LOCATION 21, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/18	2 7/21	3 7/23
VOLUME OF GAS SAMPLED, NCM	5.42	5.57	5.63
MOISTURE FRACTION VOLUME, PERCENT	7.9	8.0	7.8
AVERAGE STACK TEMPERATURE, C	91	91	92
STACK VOLUMETRIC FLOW RATE, NCMM	2015	2108	2061
STACK VOLUMETRIC FLOW RATE, CMM	2975	3119	3043
ISOKINETIC RATE, PERCENT	99.7	96.1	101.3
EXCESS AIR, PERCENT	30.4	48.7	30.4
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	0.0	0.0	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.0	0.0

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

	RUN NO.	1	2	3
	TEST DATE	7/19	7/22	7/24
	SAMPLING TIME, 24 HOUR CLOCK FROM	1003	906	900
	TO	1902	1755	1754
DN	SAMPLING NOZZLE DIAMETER, IN.	0.197	0.197	0.197
TT	NET TIME OF TEST, MIN.	504	504	504
PB	BAROMETRIC PRESSURE, IN. HG	29.10	29.38	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.23	0.88	1.15
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	328.6	271.9	326.1
TM	AVG. GAS METER TEMPERATURE, F	110	112	107
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	272.1	226.3	267.7
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	608.3	455.9	527.5
VWGAS	VOLUME OF H2O VAPOR COLLECTED,NCF	26.7	20.0	23.2
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.95	8.14	7.97
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.92	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	13.0	13.0	11.2
O2	STACK GAS O2, VOL PERCENT DRY	6.0	6.0	8.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.0	81.0	80.8
EA	STACK GAS EXCESS AIR, PERCENT	39.0	39.0	60.0
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.3	30.3	30.1
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.2	29.3	29.1
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	199	199	200
NP	NET SAMPLING POINTS	4	4	4

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

			1	2	3
	RUN NO.		1	2	3
	TEST DATE		7/19	7/22	7/24
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1003	906	900
		TO	1902	1755	1754
PST	STATIC PRESSURE OF STACK GAS, IN. HG.		0.06	0.06	0.06
PS	STACK GAS ABS. PRESSURE, IN. HG		29.16	29.44	29.41
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM		3878	3187	3651
AS	STACK AREA, SQ. IN.		4032.	4032.	4032.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)		71918	60259	68934
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)		108596	89225	102224
I	ISOKINETIC RATE, PERCENT		99.3	98.6	101.9
MF	PARTICULATE MASS--PROBE, CYCLONE, AND FILTER, MG		385.1	174.8	303.5
CAN	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)		0.022	0.012	0.017
CAT	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)		0.014	0.008	0.012
CAN3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)		0.026	0.014	0.024
CAT3	PARTICULATE LOADING--PROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)		0.017	0.010	0.016
CAW	PARTICULATE EMISSIONS--PROBE, CYCLONE AND FILTER, LB/HR		13.44	6.14	10.31

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO. TEST DATE	1 7/19	2 7/22	3 7/24
VOLUME OF GAS SAMPLED, NCF (DRY)	272.1	226.3	267.7
MOISTURE FRACTION VOLUME, PERCENT	9.0	8.1	8.0
AVERAGE STACK TEMPERATURE, F	199	199	200
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	71918	60259	68934
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	108596	89225	102224
ISOKINETIC RATE, PERCENT	99.3	98.6	101.9
EXCESS AIR, PERCENT	39.0	39.0	60.0
PARTICULATE MASS - PROBE,CYC,FILTER CATCH,			
MG	385.1	174.8	303.5
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.022	0.012	0.017
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.014	0.008	0.012
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.026	0.014	0.024
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.017	0.010	0.016
PARTICULATE EMISSIONS, LB/HR	13.4	6.1	10.3

SNOX, CONDENSER OUTLET, LOCATION 21, MULTI-METALS

RUN NO.	1	2	3
TEST DATE	7/19	7/22	7/24
VOLUME OF GAS SAMPLED, NCM	7.70	6.41	7.58
MOISTURE FRACTION VOLUME, PERCENT	9.0	8.1	8.0
AVERAGE STACK TEMPERATURE, C	92	92	93
STACK VOLUMETRIC FLOW RATE, NCMM	2036	1706	1952
STACK VOLUMETRIC FLOW RATE, CMM	3075	2526	2894
ISOKINETIC RATE, PERCENT	99.3	98.6	101.9
EXCESS AIR, PERCENT	39.0	39.0	60.0
PARTICULATE MASS - PROBE,CYC,FILTER CATCH, MG	385.1	174.8	303.5
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	49.9	27.2	39.9
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	33.0	18.4	26.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	59.9	32.7	55.4
PARTICULATE LOADING, MG/CM AT 3% O2 (WET)	39.7	22.1	37.4
PARTICULATE EMISSIONS, KG/HR	6.1	2.8	4.7

APPENDIX E

<u>QA/QC</u>

QA/QC

E-1. Sampling Completeness

The goal for data completeness in this study was defined in the QAPP as at least 85 percent. One aspect of achieving this goal is the completeness of sampling activities. Table E-1 shows the percent completeness of sampling of flue gas, solid and liquid streams at the SNOX process. Footnotes to the table identify the causes of any incomplete sampling efforts; any such deviations from plan are also discussed in Section 3.2.4 of this report.

TABLE E-1. COMPLETENESS OF SAMPLE COLLECTION AT SNOX PROCESS

Type of Sample	Completeness (percent)
Flue Gas	
Multi-Metals (Method 29)	100
Modified Method 5 (Method 23)	100
HEST Sampler	100
Canisters (VOC)	100
VOST (VOC)	100
TO-5 (Aldehydes)	100
Method 26A (Anions)	100
APHA 401 (Ammonia)	100
APHA 808 (Cyanide)	100
Filter Carbon	100
Filter Radionuclides	100
Particle Size Distribution	
Impactors	100
Cyclones	100
Solid Samples	
Boiler Feed Coal	100
Baghouse Ash	100
SO_2 Catalyst Waste	100
Liquid Samples	
Sulfuric Acid	100

E-2. Analytical

E-2.1 Elements (ICP)

Accuracy, precision, and completeness for elemental analysis conducted by CTE are provided in Table E-2. Accuracy was determined by evaluating the recovery of a known amount of a standard solution spiked into a digested sample. Precision was determined by evaluating the relative percent difference of duplicate instrument analyses of a single digested sample. A completeness of 100 percent was achieved for ICP analysis of elements.

Method detection limits (DL) for elements in gas samples were calculated using the following equation:

$$DL\ (\mu g/Nm^3) = Instrument\ Detection\ Limit\ (\mu g/mL)\ x\ \frac{Digested\ Sample\ Volume\ (mL)}{Gas\ Sample\ Volume\ (Nm^3)}$$

For example, the detection limit for cadmium in the filter from N-19-MUM-724 was calculated as follows:

$$DL = \frac{0.005\ \mu g}{mL}\ x\ \frac{150\ mL}{0.4231\ g} = 2\ \mu g/g$$

This detection limit in μg/g units was then converted to units of $\mu g/Nm^3$ as follows:

$$DL = 2\ \mu g/g\ x\ \frac{0.4231\ g}{6.776\ Nm^3} = 0.12\ \mu g/Nm^3$$

TABLE E-2. ACCURACY, PRECISION, AND COMPLETENESS FOR ELEMENT ANALYSIS

Analyte Compounds	Accuracy: How Measured	Accuracy: Target (%)	Accuracy: Actual (%)[a]	Precision: How Measured	Precision: Target (%)	Precision: Actual (%)[a]	Completeness (%)
LIQUID	Spike Recovery	75-125		RPD of Duplicate Analysis	<20		100
Aluminum			84, 95			1.4, 18	
Antimony			85-105			1, 14	
Arsenic			85-113			0-17	
Boron			NA			NA[d]	
Barium			43-101			2.7, 3.1	
Beryllium			106-110			ND[c]	
Cadmium			99-102			ND	
Cobalt			95-99			ND	
Chromium			101-103			ND	
Copper			85-102			ND, 25	
Potassium			82-100			3.8, 11	
Lead			103-120			2-14	
Manganese			90-102			ND, 8.2	
Mercury			106			0-17	
Molybdenum			98-111			ND	
Sodium			115[b]			10, 16	
Selenium			73-114			4, 13	
Nickel			98-109			ND	
Silicon			NA			NA	
Titanium			101-104			9.5, 17	
Vanadium			102-106			ND	
SOLID	Spike Recovery	75-125		RPD	<20		100
Antimony			80-95			6-11	
Arsenic			78-105			6-10	
Aluminum			NA			1.9-19	
Barium			13-131			0.2-11	
Boron			NA			NA	
Beryllium			94-102			7.4-8.7	
Cadmium			94-101			ND	
Cobalt			95-104			10-30	
Chromium			95-103			1.8-10.3	
Copper			84-98			2.2-123	
Potassium			71-94			3.2-12	
Lead			97-111			4, 4	
Manganese			91-104			0.6-7.9	
Mercury			88-112[e]			NA	
Molybdenum			92-103			ND	
Selenium			79-99			1	

TABLE E-2. (Continued)

Analyte Compounds	Accuracy: How Measured	Accuracy: Target (%)	Accuracy: Actual (%)[a]	Precision: How Measured	Precision: Target (%)	Precision: Actual (%)[a]	Completeness (%)
Sodium			-45-230			3.1-25	
Nickel			94-105			9.1-19.9	
Silicon			NA			NA	
Titanium			25-100			3.1-7.8	
Vanadium			94-100			3.6-8	
GAS	Spike Recovery[b] Reference Standards[e]	75-125		RSD of Standard Analysis	<20		100
Antimony			83-119			1-17	
Arsenic			76-115			1-21	
Aluminum			45-127			1.1-4.6	
Barium			87-104			2.4-7.9	
Beryllium			72-108			0-2.2	
Boron			NA			NA	
Cadmium			76-147			ND	
Chromium			87-143			2-8	
Cobalt			81-130[f]			0-18	
Copper			78-114			0-4.4	
Lead			85-109			1-10	
Manganese			89-136			1.8-3.5	
Mercury			80-144			0-36	
Molybdenum			97-144			ND	
Nickel			61-122			0.6-32	
Potassium			26-104			1.8-200	
Selenium			75-117			1-14	
Silicon			NA			NA	
Sodium			35-93			1.3-10	
Titanium			29-102			0-2.2	
Vanadium			86-114			ND-2.6	

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.
(b) Excludes outlier of 12 percent recovery.
(c) ND = Analyte not detected in sample therefore RPD could not be calculated.
(d) NA = Data not available or analysis not conducted.
(e) Recovery from standard reference material.
(f) Excludes outlier of 12 percent recovery.

E-2.2 Mercury

Accuracy, precision, and completeness results for CVAA analysis of mercury in gas impinger samples conducted by Battelle are presented in Table E-3. Accuracy was determined by evaluating the recovery of mercury spiked into digested sample matrix. Precision was determined by calculating the relative percent difference of duplicate instrument analyses of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all mercury analyses.

TABLE E-3. ACCURACY, PRECISION, AND COMPLETENESS FOR MERCURY ANALYSIS[a]

	Accuracy			Precision			
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)[b]	How Measured	Target (%)	Actual (%)[b]	Completeness
Mercury	Spike Recovery	75-125	92-108	RPD[c] of Duplicate Analysis	<20	0-5	100

(a) Represents results from analysis of gas samples only.

(b) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(c) RPD = relative percent deviation.

E-2.3 Ammonia/Cyanide

A summary of the accuracy, precision, and completeness obtained for the ammonia/cyanide analysis is provided in Table E-4. Accuracy was determined by calculating the recovery of a known amount of analyte spiked into a sample. Precision was determined by duplicate instrument analysis of a single sample. The accuracy and precision obtained met the target quality objectives in all cases, except for the precision associated with the duplicate analysis of a sample containing ammonia at a level less than the detection limit. A completeness of 100 percent was achieved for all samples.

The method detection limits for ammonia and cyanide in gas samples were calculated using the following equation:

$$DL\ (\mu g/Nm^3) = \frac{Instrument\ Detection\ Limit\ (\mu g/sample)}{Gas\ Sample\ Volume\ (Nm^3)}$$

No example calculation is provided since ammonia and cyanide were detected in all samples.

TABLE E-4. ACCURACY, PRECISION, AND COMPLETENESS FOR AMMONIA AND CYANIDE ANALYSIS

	Accuracy			Precision			
Analyte	How Measured	Target (%)	Actual (%)[a]	How Measured	Target (%)	Actual (%)[a]	Analytical Completeness (%)
	Spike Recovery			RPD of Duplicate Analysis			
Ammonia		75-125	100-104		<20	0-12[b]	100
Cyanide		75-125	85-105		<20	2,2	100

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(b) RPD results of 12 at 0.078 and 0.088 μgN/mL level (0.094 and 0.106 $\mu g\ NH_3$/mL).

E-2.4 Anions

Accuracy, precision, and completeness results for anion analysis are presented in Table E-5. Accuracy was determined by evaluating the recovery of target analytes spiked into sample matrix as well as analysis of a standard reference material (SRM). Precision was determined by calculating the relative percent difference of duplicate analysis of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all anion analyses.

Detection limits for anion analyses of gas samples by ion chromatography were determined by the observation of a calibration standard which when analyzed provided an approximate 3:1 signal-to-noise ratio.

Species which interfered with the chromatographical analysis of a sample, i.e. a species which overloaded the column or eluted near the retention window of interest, were corrected for by sample dilution which in turn required a proportional increase in the detection limit for the sample. The method detection limit is calculated as follows:

$$\begin{aligned} DL\ (\mu g/Nm^3) = {} & \text{Lowest Level Calibration Std } (\mu g/mL)\ x \\ & \text{Sample Dilution Factor}\ x \\ & \text{Extraction Volume } (mL)/\text{Gas Sample Volume } (Nm^3) \end{aligned}$$

For example, in the analysis of chloride in filter sample N-21-FCl-722, a large interferring peak in the chromatogram required a dilution of 1:100 to determine the chloride level. The detection limit for the sample was then determined as follows:

$$0.010\ \mu g/mL\ x\ 100\ x\ 20\ mL/1.199\ Nm^3 = 17\ \mu g/Nm^3$$

TABLE E-5. ACCURACY, PRECISION, AND COMPLETENESS FOR ANION ANALYSIS

	Accuracy			Precision			
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	Completeness
Gas (Impinger Solution)	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	NA		<20	9.4	
Fluoride		75-125	NA		<20	0.7,5.7	
	SRM Analysis						
Chloride		143-171 ppm	154,154 ppm				
Fluoride		1.55-2.02 ppm	1.84-1.92 ppm				
Gas (Filter)	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	98,125		<20	1.2,15	
Fluoride		75-125	99-108		<20	0.1,1.3	
Sulfate		75-125	100		<20	0.9,0.2	
Phosphate		75-125	114		<20	1.1	
	SRM Analysis						
Chloride		143-171 ppm	161,166 ppm				
Fluoride		1.55-2.02 ppm	1.72-1.96 ppm				
Sulfate		70.1-93.9 ppm	83.8,88.8 ppm				
Phosphate		0.555-0.779 ppm	0.589 ppm				
Solids/Liquids	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	95		<20	4.6,14	
Fluoride		75-125	106,111		<20	105	
Sulfate		75-125	86		<20	0.47-3.1,45	
Phosphate		75-125	78-113		<20	0.0	
	SRM Analysis						
Chloride		143-171 ppm	155-175 ppm				
Fluoride		1.55-2.02 ppm	1.62-1.77 ppm				
Sulfate		70.1-93.9 ppm	76.5-84.4 ppm				
Phosphate		0.555-0.779 ppm	0.648-0.730 ppm				

NA = not analyzed or data not available.

E-2.5 VOC

E-2.5.1 Gas Samples (VOST). A summary of the accuracy, precision, and completeness obtained for analysis of VOC in VOST samples is shown in Table E-6. To determine accuracy, each sample was spiked with four surrogate compounds prior to analysis. Recovery of the surrogate spike was then considered as the analytical accuracy. As shown, the surrogate spike recovery met the original objectives of 26-160 percent in most cases.

A method detection limit of 25 ng/sample was determined by calculating ten times the standard deviation of replicate analyses of a 50 ng standard. Detection limits for individual samples were then calculated by dividing 25 ng/sample by the associated gas sample volume.

TABLE E-6. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC VOST ANALYSIS

	Accuracy			Precision			
Analyte/Spike Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	Completeness
	Surrogate Spike Recovery						100
d_4-1,2-Dichloroethane		26-160	42-128		<20	NA	
d_8-Toluene		26-160	63-164, 503[a]		<20	NA	
d_6-Benzene		26-160	77-139		<20	NA	
p-Bromofluorobenzene		26-160	26-112		<20	NA	

(a) Interference in sample may have contributed to high percent recovery.

E-2.5.2 Gas Samples (Canister). A summary of the precision, accuracy and completion obtained for analysis of VOC in canister samples is shown in Table E-7. Information on accuracy was obtained from a canister spiked with four target compounds. The concentrations of the four components were established by reference to the 41 component calibration cylinder. This cylinder has been recently audited by US EPA and shown to be within $\pm$ 10 percent of the stated values for 15 compounds common to both mixtures. The contents of the spiked canister were directed through the sampling train and into a second canister. Both canisters were analyzed to determined the amount recovered. Analytical precision was determined by repeated analyses (3 times) of a 1/100 dilution mixture from the 41 component calibration cylinder. The four components used during the field spike experiment are reported. A completeness of 100 percent was achieved for canister analyses.

Detection limits for VOC in canister samples were calculated as follows:

$$DL\ (ppb) = \frac{Concentration\ of\ Stds\ (ppb)}{Average\ of\ Range\ of\ Std\ Peak\ Areas\ (all)} \times 3 \times (Peak\ Area\ Noise)$$

The calibration cylinder contained the 41 target components each at a nominal concentration of 200 ppb. The cylinder was dynamically diluted to the 6 ppb level. Using the selective ion monitoring mode of the GC/MS, area counts from 850,000 to 1,700,000 were obtained for the target compounds. The peak area noise was approximately 35,000 area units. No changes in electron multiplier gain was made during the study so the above responses hold throughout the time period. With these results, the actual detection limit achieved was calculated as follows:

$$DL\ (ppb) = \frac{6\ ppb}{((1{,}700{,}000 + 850{,}000)/2)} \times 3\ (35{,}000) = 0.5\ ppb$$

The detection limit in ppb units was then converted to $\mu g/Nm^3$ units by multiplying by a conversion factor. For example, 1 ppb of trichlorofluoromethane at 0°C and 760 mm is equal to 6.11 $\mu g/Nm^3$; therefore the converted detection limit was 3.06 $\mu g/Nm^3$.

TABLE E-7. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC CANISTER ANALYSES

	Accuracy			Precision			
Analyte/Spike Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	Completeness (%)
	Spike of Sampling Train with Canister			RSD[a] of Replicate Analysis of Standard Cylinder			100
Benzene	25.6 $\mu g/Nm^3$	75-125	108		< 20	± 14	
Toluene	23.0 $\mu g/Nm^3$	75-125	122		< 20	± 7	
Ethylbenzene	25.6 $\mu g/Nm^3$	75-125	109		< 20	± 8	
Styrene	19.2 $\mu g/Nm^3$	75-125	102		< 20	± 16	

(a) RSD = relative standard deviation.

E-2.6 PAH/SVOC

Accuracy, precision, and completeness results for PAH/SVOC analysis of gas and solid samples are presented in Table E-8. Accuracy was determined by recovery of perdeuterated PAH spike compounds added to the samples prior to extraction. In most cases, spike recoveries met the target objective of 50 to 150 percent. Precision was determined by evaluating the relative standard deviation of calibration standard analyses. The average relative standard deviation (RSD) for three calibration standards, 0.05 ng/μL, 0.1 ng/μL, and 0.5 ng/μL is presented in Table E-8. As shown, this average RSD is below the target 30 percent in all cases. Individual RSD for these three standards were also below the 30 percent target. A completeness of 96 percent (23 samples analyzed/24 samples received) was achieved due to the loss of the XAD-2 resin from sample N-20-MM5-718 during sample preparation. A completeness of 100 percent was achieved for the solid samples.

The estimated detection limit for PAH is 0.01 ng on column and for SVOC is 0.05 ng on column with a 1-μL injection. At these concentration levels, the signal-to-noise ratio is about 3. The detection limit for PAH/SVOC was calculated using the following equation:

$$DL = \frac{Estimated\ Detection\ Limit\ Concentration\ x\ Final\ Volume\ of\ Extract\ Analyzed}{Gas\ Sample\ Volume\ \ x\ \ Fraction\ of\ Extract\ Analyzed}$$

For example, the detection limit for hexachloroethane in N-18-MM5-X-718 was calculated as follows:

$$\frac{0.05\ ng/\mu L\ x\ 2000\ \mu L}{5.8014\ x\ 1.0} = 17.2\ ng/Nm^3$$

TABLE E-8. ACCURACY, PRECISION, AND COMPLETENESS FOR PAH/SVOC ANALYSIS OF GAS AND SOLID SAMPLES

	Accuracy			Precision			
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	Completeness
	Recovery of Perdeuterated PAH Spike						
GAS							96
d_{12}-Chrysene		50-150	55-115				
d_{12}-Benzo(k)fluoranthene		50-150	43-143				
SOLID							100
d_{12}-Chrysene		50-150	53-56				
d_{12}-Benzo(k)fluoranthene		50-150	47-56				
				RSD of Calibration Standard Analysis	< 30		
GAS/SOLID							
Benzylchloride						15.9	
Acetophenone						15.1	
Hexachloroethane						11.3	
Naphthalene						7.5	
Hexachlorobutadiene						11.2	
2-Chloroacetophenone						8.2	
1-Methylnaphthalene						7.4	
2-Methylnaphthalene						5.3	
Hexachlorocyclopentadiene						12.3	
Biphenyl						6.6	
Acenaphthylene						5.2	
2,6-Dinitrotoluene						7.9	
Acenaphthene						6.4	
Dibenzofuran						6.9	
2,4-Dinitrotoluene						8.8	
Fluorene						6.1	
Hexachlorobenzene						6.5	
Pentachlorophenol						11.2	
Phenanthrene						11.6	
Anthracene						6.7	
Fluoranthene						13.2	
				RSD of Calibration Standard Analysis			

TABLE E-8. (Continued)

Analyte/Surrogate Compounds	Accuracy: How Measured	Accuracy: Target (%)	Accuracy: Actual (%)	Precision: How Measured	Precision: Target (%)	Precision: Actual (%)	Completeness
Pyrene						9.2	
Benz(a)anthracene						8.6	
Chrysene						6.0	
Benzo(b&k)fluoranthene						8.0	
Benzo(e)pyrene						7.5	
Benzo(a)pyrene						9.2	
Indeno(1,2,3-c,d)pyrene						10.5	
Dibenzo(a,h)anthracene						11.1	
Benzo(g,h,i)perylene						6.5	

E-2.7 Aldehydes

Accuracy, precision, and completeness results for analysis of aldehydes in gas samples are presented in Table E-9. Accuracy was determined by recovery of analytes spiked into water. As shown, except for a 179 percent recovery of formaldehyde spiked into water at or near the method detection limit, all recoveries met the target objective of 50 to 150 percent. The precision was determined by the relative standard deviation of standard analyses and also met the target objectives. Completeness of 100 percent was obtained for both gas and liquid samples.

Method detection limits for aldehydes in gas samples were calculated using the following equation:

$$DL(\mu g/Nm^3) = A_{min} \, x \, \frac{C_{std}(\mu g/mL)}{A_{STD}} \, x \, \frac{V_{e-avg}(mL)}{V_{sampled}(Nm^3)} \, x \, \frac{MW_{neat}}{MW_{DER}}$$

where:

DL = Detection Limit

A_{min} = Minimum detectable peak area of carbonyl

A_{std} = Peak area of carbonyl derivative in standard solution

C_{std} = Concentration of carbonyl derivative in standard solution

V_{e-avg} = Average final volume of DNPH-acetonitrile solution

$V_{sampled}$ = Average volume of air sampled

MW_{neat} = Molecular weight of neat carbonyl compound

MW_{DER} = Molecular weight of carbonyl derivative.

Actual detection limits were calculated as follows:

$$4300 \, x \, \frac{2 \ \mu g/mL}{334293} \, x \, \frac{31.7 \ mL}{0.0455 \ Nm^3} \, x \, \frac{30.03}{210} = 2.6 \ \mu g/Nm^3$$

TABLE E-9. ACCURACY, PRECISION, AND COMPLETENESS FOR ALDEHYDE ANALYSES

Analyte/Spike Compounds	Accuracy			Precision			Completeness (%)
	How Measured	Target (%)[a]	Actual (%)[a]	How Measured	Target (%)	Actual (%)	
GAS	Spike Recovery			RSD of Standard Analysis			100
Formaldehyde		50-150	114-122[b]		± 15	0.45	
Acetaldehyde		50-150	85-100		± 15	0.57	
Acrolein		50-150	NA[c]		± 15	0.32	
Propionaldehyde		50-150	81-95		± 15	0.59	

(a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

(b) Excludes 179 percent recovery for spike at detection limit of method.

(c) NA = Not analyzed.

E-2.8 Radionuclides

Accuracy, precision, and completeness results for radionuclide analysis are presented in Table E-10. Accuracy was determined by evaluating the recovery of cesium-137 spiked into sample matrix. Precision was determined by evaluating results of duplicate sample analyses. The precision achieved met the target objective of ±3 standard deviations; relative percent differences (RPD) are provided in Table E-10 for comparability with other analytical data. A completeness of 100 percent was obtained for all radionuclides analyses.

The method detection limit for radionuclides was calculated using the following equation:

$$MDC = \frac{4.65\sqrt{BKG} + 2.71}{(2.22)(EFF)(AVOL)(CTIME)(Ab)(D)}$$

where:

MDC	=	Minimal detectable concentration
BKG	=	Background counts
EFF	=	Counting efficiency
AVOL	=	Aliquot volume (g or L)
CTIME	=	Count time (min)
Ab	=	Abundance of emission
D	=	Decay correction
2.22	=	Conversion from dpm to pCi
4.65, 2.71	=	Constants.

This equation is derived from the following reference:

"Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements", L. A. Currie, NUREG/CR-4007, U.S. Nuclear Regulatory Commission, September 1984.

TABLE E-10. ACCURACY, PRECISION, AND COMPLETENESS FOR RADIONUCLIDE ANALYSIS

Analyte/Surrogate Compounds	Accuracy			Precision			Completeness
	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	
	Spike Recovery			RPD of Duplicate Analysis[b]			100
Cs-137		NA	100-109				
Pb-210					--	5	
Pb-212					--	14	
Ra-226					--	1	
Ra-228					--	20	
Th-234					--	10	
U-234					--	49	
U-235					--	33	

(a) Precision not provided for radionuclides not detected in both sample and duplicate.

(b) All duplicate results agreed to with ±3 standard deviations target objective; RPD provided for comparability with other analytical data.

NA = Not available.

E-3. Method Detection Limit

Approximate emission detection limits obtained for gas samples in which analytes were not detected are listed in Table E-11.

TABLE E-11. EMISSION DETECTION LIMITS

	Actual Emission Detection Limit ($\mu g/Nm^3$)[a]	Target Emission Detection Limit ($\mu g/Nm^3$)
Element		
Mo	NC	1.5
B	NC	1.2
Sb	1.0	0.3
As	NC	0.06
Ba	NC	0.3
Be	NC	0.3
Cd	0.2	0.3
Cr	NC	1.2
Pb	NC	0.06
Mn	NC	0.3
Hg	NC	0.03
Ni	NC	1.2
Se	NC	0.12
V	NC	0.6
Cu	NC	0.6
Co	0.3	0.9
Ammonia	NC	750
Cyanide	NC	191
Anions		
F^-	NC	3
Cl^-	15	3
$PO_4^{\equiv}$	6	30
$SO_4^{=}$	NC	7.5
PAH/SVOC	0.4-20	0.1-10 ng/Nm^3[b]
Aldehydes	2	2
VOC - Canister	4	6
VOC - VOST	6	1.3-7.5

(a) Approximate emission detection limit obtained in sample analyses. Values for PAH/SVOC are in ng/Nm^3.
(b) Calculated target emission detection limit will range from 0.1 to 10 ng/Nm^3 depending upon SVOC compound and matrix.

NC = Not calculated because analyte concentration was above method detection limit in samples.

APPENDIX F

ANALYTICAL PROTOCOL

F-1. Element Analytical Protocols

Elements in flue gas, solid, and liquid samples were analyzed by various methods (ICP, GFAA, PIXE, CVAA) according to the procedures described in the QAPP. Specific deviations from those procedures were as follows:

(1) Samples sent to CTE for analysis instead of Battelle. In order to meet the reporting deadline, it was necessary to send process solid, process liquid, PSDS filter, and gas samples (excluding impinger samples for mercury analysis) to Commercial Testing and Engineering Company (CTE) in Denver, Colorado for analysis. CTE followed the Quality Assurance Plan for element determinations with the following exceptions:

- The analyses of solid samples by CTE for mercury were accomplished by a double gold film amalgamation. No spike samples were performed due to the use of a solid sample matrix. However, recoveries for solid reference materials were within the limits established for this program.

- Silicon, aluminum, titanium, potassium, and sodium, in solid samples (boiler feed coal, SO_2 catalyst waste, and baghouse ash) were determined by X-ray fluorescence spectroscopy, in accordance with ASTM 04326, instead of ICP.

(2) The H_2O_2 reagent blank was lost during sample preparation. Train blanks are not corrected for this reagent blank. Samples results, by process of subtracting train blank results, are corrected for contributions from this reagent.

(3) Filter reagent blanks analyzed for elements had unexplained outlying results in several cases. Duplicate Pallflex 102 mm filter reagent blanks were analyzed. Results for one of these reagent blanks were as expected with element concentrations equivalent or significantly below sample results. The second Pallflex 102 mm filter reagent blank had extremely high concentrations of aluminum, potassium, and sodium which were considered outliers and not considered in blank corrections.

Likewise in the analysis of triplicate Pallflex 86 mm filter reagent blanks, outlying results were obtained for aluminum and sodium in one blank and for potassium in a second blank. Again, these outlying results were not included in reagent blank corrections.

(4) Problems with Si and B determinations of Method 29 samples by CTE. Boric acid was used to complex excess hydrofluoric acid after microwave digestion by CTE. Hydrofluoric acid may also react with glassware or the glass mixing chamber of the ICP analyzer, and may interfere with silicon results. Thus CTE has not reported Si and B results for some samples.

(5) The Method 29 filter was analyzed separately from the combined acetone/acid probe rinses for ICP and GFAA analyses. This deviation was required to allow evaluation of the particle size distribution of elements in the flue gas emissions.

F-2. Ammonia/Cyanide Protocols

Samples were analyzed for ammonia and cyanide according to the procedures stated in the QAPP.

F-3. Analytical Protocol for Anions

F-3.1 Summary of Method for Anion Analysis by Ion Chromatography

Anions of interest are separated and measured using a Dionex DX300 ion chromatography system comprised of a guard column, separator column, MicroMembrane suppressor, and conductivity detector. The separator column selectively separates ions based upon their affinity for an ion-exchange resin. The suppressor converts the eluted ions to acids which are then measured by a conductivity meter. Identification of the ions is made by their retention time on the column. Quantification is done by comparing peak height or area responses to those of calibration standards.

F-3.2 Deviations from Method 26A

(1) The analysis of EPA Performance Evaluation Samples (WP029) was used instead of EPA "Audit Samples" designated in Section 7.7.1 of Method 26A.
There is no effect on results because of this deviation from Method 26A. The acceptable range for either must be analytically achieved to assure method accuracy. The target values are documented by the EPA and the analysis results are recorded in the project laboratory record book.

(2) Calibration standards were prepared in deionized water instead of 0.1 N H_2SO_4 as stated in Section 5.2 of Method 26A.
As the majority of the analyses required dilution in deionized water to conform to the analytical range of the detector, deionized water was the appropriate solvent for the calibration standards. There should be no adverse effect on results from this alteration.

F-3.3 Deviations from Method 300.0

(1) The instrument calibration is verified approximately each hour of operation with the analysis of an Instrument Calibration Verifier (ICV) which has a tolerance of 20 percent from the known value. Section 9.4 of Method 300.0 states that the tolerance should be 10 percent. Although 10 percent is achievable precision (see RPD's of duplicates), ICV's require 20 percent because they are analyzed around the clock where temperature changes contribute to a small amount of instrumental drift above 10 percent.

F-3.4 Deviations from the QAPP

(1) The Custody During Lab Analysis (5.1.3.3) section states that quality control samples will be documented in a bound lab record book and assigned an LRB number. The ion chromatography lab uses a sample log for all incoming samples

from which a unique 4-digit number is assigned. Copies of logged samples will be entered into a bound LRB. The chain-of-custody-form copies will serve as a record of the personnel involved and the times involved in sample-handling transactions.

(2) Data Quality Objectives (Table 5-4) should state that a standard reference material (EPA WP029) will be used as an accuracy determiner when the matrix spike is not applicable, i.e., the spiked sample is unmeasurable because of column and/or detector overload or because of matrix dilution necessary for linear range detection.

(3) The target values for the WP029 samples were achieved with each calibrated sample run except one. The result of WP29 chloride for Niles, Run #3, Solids, was 176 ppm. The acceptable range is 143-171 ppm. The oversight was discovered too late to be corrected. Considering the fact that all of the other QC analyses for this sample run and specifically those surrounding this analysis were within the control limits, the run was not invalidated.

F-4. Analytical Protocol for VOC

F-4.1 VOST Samples

Analysis of VOST sorbent traps for VOC was conducted as described in the QAPP, according to the provisions of SW-846 Method 5041, using thermal desorption GC/MS. Each sampled pair of VOST traps was placed in a heated desorption unit and purged with organic-free nitrogen or helium. The purge gas flow transferred VOC desorbed from the VOST traps to a cold trap for focussing. Heating of the cold trap released collected VOC in a small volume onto the inlet of the GC column. The VOC were then determined by temperature programmed chromatography with detection by low resolution mass spectrometry. Internal standards were used to quantify the VOC. The one deviation from plan was that hexane was not determined in VOST samples.

F-4.2 Canister Samples

Canister samples were analyzed with a gas chromatograph equipped with a mass spectrometric detector. Upon receipt, the initial pressure of each can was recorded and the can was filled with zero air to facilitate sample extraction. The initial and final pressures were used to determine the dilution correction factor. Since acidic gases have been shown to strip the analytical column of bonded liquid phase within a short time period sampled air from the canister was first directed through a sodium bicarbonate trap to reduce the content of acidic gases. The use of alkaline water was originally specified in the Analytical Management Plan but was shown prior to the field study to partly remove several of the target compounds when challenged with the 41 component calibration mixture. The effluent from the sodium bicarbonate trap was then directed to an adsorbent trap (Carbopak B/ Carbosieve S-III) to preconcentrate the target VOC species. A six port valve and thermal desorption step were used to inject the adsorbed material onto the analytical column. The column was temperature programmed from -50 to 200°C to resolve the VOC. Selective ion monitoring was used to quantify the target species. However, sufficient acidic gases were still present in the injected sample that prohibited the operation of the mass spectrometer until 11 minutes into the run. As a result, the first six species on the 41 component target list were not analyzed. A method detection level of 0.5 ppb was achieved with a sample volume of 60 cm^3.

F-4.3 Liquid VOC Samples

Volatile organic compounds (VOC) in liquid samples were analyzed by Zande Environmental Laboratories using purge and trap gas chromatography/mass spectrometry. EPA SW846 Method 8240 was followed for the analysis of these samples. All samples were initially analyzed within 14 days of receipt at the laboratory.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8240. The system was initially tuned with 4-bromofluorobenzene prior to analysis of the initial calibration curve. An attempt to tune the system every 12 hours of operation was made, but the 12 hour window was exceeded by 10 minutes in one instance and 20 minutes in another. A couple of tunes also failed to meet the abundance ratio criteria found in Method 8240. Continuing calibration standards were analyzed every twelve hours and in all instances but two met the continuing calibration criteria required by Method 8240. There were no target analytes present in any of the samples.

F-5. Analytical Protocol for PAH/SVOC

F-5.1 Gas and Solid Samples

The MM5 samples were prepared according to the Niles Analytical Plan. The MM5 filter and probe rinse filter were spiked with known amounts of d_{12}-chrysene and d_{12}-benzo(k)fluoranthene before Soxhlet extraction. The filters were then extracted with dichloromethane (DCM) for 18 hours. Note that in the QAPP the extraction time is indicated as 16 hours, but the actual extraction time for all the samples was 18 hours. The DCM extract was combined with the filtrate from the probe rinse and concentrated by Kuderna-Danish (K-D) evaporation. Note that the concentrated probe rinse extracts were acidic and contained water. Thus 50 mL of DCM and 50 mL of water were added to the concentrated probe rinse extract. The water layer was adjusted to pH of 7, and then extracted twice with 50 mL of DCM. The DCM extracts were combined, dried with sodium sulfate, and concentrated to 1 mL for combination with the corresponding filter extract. Cyclone samples collected at Location 18 were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL by K-D evaporation for silica gel column chromatography.

The XAD-2 samples were spiked with perdeuterated PAH and/or ^{13}C-labelled dioxin/furan and extracted with DCM. The condensate was adjusted to pH 7 and extracted with DCM according to the QAPP. The XAD-2 extract was combined with the module rinse and condensate, and concentrated to 1 mL for silica gel column chromatography.

Aliquots of the solid process samples were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL for silica gel column chromatography.

The DCM extract was solvent exchanged into hexane (C_6) and applied to a silica gel column. The column was packed with 5 percent water deactivated silica gel with C_6. Three elution solvents, C_6, C_6/DCM (50/50), and methanol were applied to the column. The C_6/DCM fractions were concentrated to 1 mL with K-D evaporation and further concentrated to 100 μL with nitrogen evaporation for GC/MS analysis. Some of the C_6/DCM fractions of XAD-2 extracts were diluted to 1 mL or more to minimize sample matrix effects for GC/MS analysis. The methanol fractions were concentrated to 1 mL, evaporated almost to dryness, and solvent exchanged into 1 mL of DCM, however these fractions were not analyzed. The only target analyte expected in this fraction is quinoline for which data are not provided.

A Finnigan TSQ-45 GC/MS/MS operated in GC/MS mode equipped with an INCOS 2300 data system was employed. Helium was the GC carrier gas and a 70 ev electron beam was used. The MS was operated in the selected ion monitoring mode. Ion peaks monitored by MS are the molecular ions and characteristic fragment ions of target analytes. Identification of the target analytes was based on the correct molecular ion, correct fragment ions, and the correct retention time relative to the internal standard. Quantification of each target analyte followed the method described in the QAPP.

F-5.2 Liquid SVOC Samples

Semivolatile organic compounds (SVOC) in liquid samples were extracted and analyzed by Battelle using liquid/liquid extraction, and analysis by gas chromatography/mass spectrometry. EPA SW846 Method 3560 and 8270 was followed for the analysis of these samples. All samples were initially extracted within 7 days of receipt at the laboratory and the extracts analyzed within 40 days.

One liter aliquots of each sample were fortified with the appropriate surrogate compounds to monitor extraction efficiency, serially extracted three times with methylene chloride, concentrated to 1 mL, fortified with internal standards and analyzed on an HP 5970 MSD. Every sample with the exception of blanks and spiked blanks formed emulsions during the base/neutral extraction. Due to the formation of emulsions, during the base/neutral extraction, each 60 mL aliquot of extract was collected in a centrifuge bottle, centrifuged, the organic removed and the remainder added back to the separatory funnel prior to the next addition of solvent. Once the samples were acidified, emulsions did not form and the samples were processed without centrifugation. No problems were encountered in the concentration step.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8270.

The system was initially tuned with decafluorotriphenylphosphine prior to analysis of the initial calibration curve. The system was also tuned every twelve hours of operation and met the required ion abundances. Continuing calibration standards were analyzed every twelve hours and in all instances met the continuing calibration criteria required by Method 8270 for CCCs and SPCCs. Method 8270 allows for 30 percent RSD on CCCs and this criteria was used. The QAPP incorrectly stated 25 percent RSD.

F-6. Analytical Protocol for Aldehydes

Gas samples (DNPH impinger solutions) and liquid process samples were analyzed for formaldehyde, acetaldehyde, acrolein, and propionaldehyde using high performance liquid chromatography with ultraviolet detection (HPLC/UV). Prior to the collection of the gas aldehydes, the DNPH reagent for the impinger samples was prepared by mixing 0.06 g of purified DNPH crystals per 250 mL of acetonitrile. Fifty (50) μL of sulfuric acid was also added to each 250 mL of DNPH reagent.

After the gas samples had been collected and prior to analysis, the volume of DNPH impinger solution collected from each impinger was measured with a graduated cylinder. Next, a 4-mL aliquot from each sample was transferred to a 4-mL HPLC sample vial with a septa-seal top. The HPLC vials were used as the permanent storage vessel for the impinger samples. These HPLC vials were refrigerated before and after analysis.

For liquid samples (both process liquid samples and condensed water samples from the gas sampling trains), all samples were reacted with DNPH just prior to analysis. An aliquot of 2 mL of each liquid sample and 2 mL of DNPH reagent were mixed in a 4-mL HPLC sample vial with septa-seal top. The HPLC vials were used as the permanent storage vessel for the liquid samples. The liquid-DNPH solutions were allowed to react for at least 3 hours prior to analysis. This reaction time is necessary to assure that all of the aldehyde species present in the liquid will be converted to carbonyl-DNPH derivatives. After the waiting period, the samples were analyzed. For the liquid samples, standards were prepared by adding the neat aldehydes to HPLC water at concentrations above and below those found in the actual samples. The standard water samples were reacted with the DNPH in the same manner as the actual samples.

For the process liquid samples, additional sample preparation steps had to be implemented because of the potential for suspended solids in the samples. Prior to reaction with the DNPH solution, the process liquid samples were filtered through a 0.22 μm filter.

After the liquid samples were reacted with the DNPH, a white precipitate settled out in a few of the samples. To protect the HPLC system, the liquid above the precipitate was decanted off and placed into a new HPLC vial. It was this liquid that was analyzed on the samples in which precipitation occurred.

All of the samples were analyzed with a Waters HPLC system. An acetonitrile/H_2O mixture (65/35) serves as the mobile phase. Column flow is 0.8 mL/min. Typically, the injection volume used for aldehyde samples was 30 μL.

F-7. Analytical Protocol for Radionuclides

Radiological analysis of both the gas (filter) samples and the solid samples was performed by the International Technology (IT) Corporation's Oak Ridge, Tennessee laboratory using a gamma scan method. The samples were prepared for gamma spectrometry using that laboratory's standard operating procedure OR-7003, Revision 0. Then the radioactivity counts were obtained using IT-Oak Ridge standard operating procedure OR-7212, Revision 0.

During the analysis procedures the following reports were prepared:

(1) Gamma Spectroscopic Analysis Parameters

(2) Summary of Positively Identified Nuclides

(3) Summary of Unidentified Nuclides

(4) Peak Search Report (Gross)

(5) Peak Search Report (Net)

(6) Summary of Nuclide Activity

(7) Nuclide Line Activity Report

(8) Full Combined Activity - MDA Report

(9) Unidentified Energy Lines Report

(10) Total Uranium Analysis Parameters and Summary

(11) Full Combined Uranium Activity - MDA Report

For each sample the analysis results were summarized by reporting the activity in pico Curies per gram for the following isotopes as was called for in the QAPP:

Pb-210	Pb-211
Pb-212	Th-229
Ra-226	Th-230
Ra-228	U-234
Th-234	U-235

APPENDIX G

UNCERTAINTY ANALYSIS

UNCERTAINTY ANALYSIS

An error analysis was conducted to provide an estimate of the uncertainty of the reported values for average emission factors. Emission factors on three days are reported in Section 6 along with the arithmetic average, $\bar{E}$. Daily emission factors were calculated by:

$$E_i = \frac{2.205 * g * (s+v)}{(HHV * cf)} \quad \text{(G-1)}$$

where

E_i = daily emission factor, lb/10^{12}Btu
g = daily flue gas flow rate, Nm^3/hr
s = daily solid phase concentration of substance in flue gas, $\mu g/Nm^3$
v = daily vapor phase concentration of substance in flue gas, $\mu g/Nm^3$
HHV = daily higher heating value of feed coal, Btu/lb
cf = coal feed rate, klb/hr

A goal of the project was to determine a representative value for E, the average emission factor for a substance from the power plant. The reported value of $\bar{E}$ is an average from only three days of sampling. Daily variation in operation of the power plant contributes to uncertainty in the estimation of the long term average emission rates of substances.

G-1. Identification of Sources of Error

Two types of errors must be considered (ANSI/ASME PTC 19.1-1985, "Measurement Uncertainty", available from the American Society of Mechanical Engineers): random errors (or precision errors) and bias.

Three factors contribute to precision errors or variability in the reported daily emission factors. First, plant operating conditions change from day to day. Second, variability in collecting samples leads to errors in determining the five parameters in equation G-1 that are used to calculate the estimate of E_i. Third, variability in analyzing the collected samples for s, v, and HHV leads to errors in estimating E_i.

Bias in determining E_i can result from systematic errors in determining any of the five parameters in equation G-1. Bias errors are assumed to be constant throughout the measurement process. They can be significant, known and accounted for in calibrations; insignificant, known, and ignored in the uncertainty analysis; or estimated and included in the uncertainty analysis. The bias, when included in an uncertainty analysis, is estimated as a upper limit of the bias error.

G-2. Procedures for Estimating Uncertainty

The error analysis for this project was designed to provide uncertainty intervals around the reported average emission factors of the form

$$\textit{Emission factor } (lb/10^{12}\ Btu) = \bar{E} \pm (U^2 + B^2)^{1/2} \qquad \text{(G-2)}$$

where

$\bar{E}$ = arithmetic average of the daily emission factors E_i

U = an approximate 95% confidence bound accounting for random errors

B = possible bias due to systematic errors.

For cases in which the average emission factor is based upon three non-detected values, the uncertainty was taken to equal the reported "less than" value for the average emission factor. Otherwise, the estimates of precision and bias errors were made as follows.

Precision Errors

The 95% confidence bounds were calculated by

$$U = \frac{t*S}{\sqrt{3}}$$

where

t = 4.303, the upper 97.5 percentile of Student's t distribution with two degrees of freedom

S = standard deviation of the three daily emission factors.

Thus,

U = 2.48*S.

The resulting confidence level is approximately 95 percent. This assumes that the distribution of daily emission factors for each substance approximates a normal distribution.

Battelle evaluated whether or not to use propagation of error methods, such as those described in the ANSI/ASME document cited above, to determine the statistical uncertainty of the average emission factors. Propagation methods are often used to establish the uncertainty of a function of several measured input parameters. Battelle believes that the approach described above is preferred over propagation of error methods because the objective of this error analysis is to estimate the uncertainty of the average of independent determinations of daily emission factors. Computing the standard deviation of the E_i accounts for the three sources of variability cited above: day-to-day variations in plant operations, sampling error, and measurement error. The propagation of errors method is an approximate solution that will produce similar results, provided that the correlations among the input parameters are taken into account. For example, one would expect a high degree of correlation between the measured solid and vapor phase concentrations on each day and between the daily coal feed rates and flue gas flow rates.

Bias

The potential bias on E due to systematic errors in any of the five measured parameters in equation G-1 was calculated by

$$B = (\Sigma B_j^2)^{1/2} \qquad \text{(G-3)}$$

where $B_j = dE/dp_j * \beta_j$ is the resulting bias in E caused by a systematic error of β_j in measuring parameter p_j ($j=1$-5 for g, s, v, HHV, and cf). These errors could not be specifically identified or confirmed; thus no correction was applied to the measured parameters. Battelle's estimates of the values of β_j are described below.

Flue gas flow rate. Determination of the flue gas flow rate, g, was assigned an upper limit of twelve percent for bias error. The bias for the gas flow measurement was estimated by comparing measured gas flows rates to flow rates calculated from the coal feed rate and the oxygen content at the various sampling points. The measured flow rate used to calculate emissions factors was taken to be the measured flow rate of flue gas at Location 18 corrected for additional flow from the two support burners ahead of Location 21 (see Section 6 for an explanation of this procedure). The average difference between the "measured" and calculated flue gas flow rates was eight percent. This value was assigned to the parameter β_1.

Solid phase concentrations. Solid phase concentrations, s, were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-1.

Sources of analytical bias (Quality Assurance for Chemical Measurements; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987) are listed in Table G-2 along with the estimate of the magnitude of the bias associated with each source. The estimates shown in Table G-2 were derived as follows:

Inefficiency Losses - Results for organic analyses are corrected for extraction recoveries. A bias of 2 percent is estimated for inorganic analyses based on matrix spike and SRM recovery results.

Calibration - For most organic and inorganic analytes, routine calibration results were required to be within ± 25 percent of initial calibration. Battelle's estimate of the bias in calibration is 5 percent.

Interference Resolution - The estimate of bias is zero because interferences are typically corrected for in organic and inorganic analyses or data are flagged as being affected by interference.

Contamination Gains - Data are corrected for contamination gains derived from field sampling, sample handling, and sample shipping by subtracting train blank results from sample data; therefore, the bias estimate is zero.

Instrumental Shifts - Instrumental shifts are considered to be corrected for by calibration bias; .therefore the estimate is zero.

Matrix Effects - Matrix effects are evaluated by use of matrix spike samples. The estimate is zero because no consistent bias was detected in analysis of either inorganic or organic matrix spike samples.

Theoretical - Battelle's extensive experience with the inorganic and organic analyses conducted on this program has not detected any consistent bias based on theoretical effects; therefore the estimate is zero.

Operator Bias - Many of the analyses were conducted by different operators and no consistent bias was detected; therefore the estimate is zero.

Tolerance Adjustments - Based on Battelle's laboratory analysis experience, consistent bias with tolerance adjustments is nonexistent; therefore the estimate is zero.

Uncorrected Blank - Most sample results are corrected for laboratory method blanks and reagent blanks (where applicable) or blank results are negligible. Therefore the estimated bias from uncorrected blanks is zero.

Based upon these estimates, a bias error of five percent for organic solid phase determinations was estimated. Seven percent was estimated for inorganic solid phase determinations.

Considering both sampling and analysis together, the estimates of β_j for solid substances were computed as the square root of the sum of the squares of the individual bias estimates (see Table G-4).

__Vapor phase concentrations__. Vapor phase concentrations, v, were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-3.

Sources of analytical bias and associated bias estimates for vapor phase samples are the same are those listed in Table G-2 for solid phase samples except for the bias associated with the inefficiency losses for inorganic analyses. This bias is estimated to be 1 percent rather than 2 percent because the difficulty with preparing liquid phase samples for inorganic analysis is typically less than that for solid phase samples.

Combining the errors for sampling and analysis, Battelle estimated the β_j for vapor substances as shown in Table G-5.

__Higher heating value of coal__. The bias for the coal heating value determination was estimated at 2 percent. This estimate is based on the fact that the coal heating value is determined by a well-proven ASTM procedure by laboratories doing many samples daily. Additionally, utilities keep careful watch over their boiler efficiency and heat rate values. As the heating value is a major input to boiler efficiency and heat rate calculations, a bias as large as 2 percent would be obvious. Hence, a 2 percent bias estimate was assigned to the heating value determinations.

__Coal feed rate__. The bias for the coal feed rate measurement for the Niles Station Boiler No. 2 was estimated at 2 percent. In general, keep careful watch over their fuel consumption and boiler efficiency. (The cost of fuel is typically 40 to 50 percent of the cost of generating electricity and, thus, is of major importance.) A bias as large as 2 percent in the fuel feed rate would be very obvious to the plant operators and action would be taken to correct any problem. Review of operations at Niles Station led to assignment of two percent for the parameter β_5.

__Summary__. The estimated upper limits for bias terms β_j are listed in Table G-6. Because of the uncertainty in estimating values for the β_j themselves, a decision was made to combine the values for β_2 and β_3 into one term. Therefore the values of $\beta_{2/3}$ were assigned as follows: elements - 7 percent, anions - 7 percent, radionuclides -9 percent, particulate matter - 8 percent, SVOC - 7 percent, ammonia/cyanide - 6 percent, VOC 8 percent, and aldehydes -6 percent. Together with calculations of precision error, these terms were used to calculate uncertainty intervals for emission factors in Section 6.

G-3. Example Calculation

The following example calculation applies to calculating the uncertainty in the average emission factor for mercury.

Daily emission factors were calculated using Equation G-1:

$$E_1 = \frac{2.205 * 104{,}820 * 36.2}{12{,}249 * 25.8} = 26.5\ lb/10^{12} Btu$$

$$E_2 = \frac{2.205 * 106{,}984 * 21.9}{12{,}218 * 26.5} = 16.0$$

$$E_3 = \frac{2.205 * 107{,}625 * 30.7}{12{,}306 * 26.8} = 22.1$$

The parameters used to calculate E_i, for July 19, 1993, are found as follows:

Parameter	Value	Where Found
g	104,820 dscm/hr	Table 3-13b as 2,099 Nm^3/min at stack O_2 or 2,099/1.2013 at 3% O_2
s+v	36.2 $\mu g/Nm^3$	Table 5-8
HHV	12,249 Btu/lb	Table 5-52
cf	25.8 klb/hr	Table 2-4 as 91,700 lb/hr for Boiler 2 91,700 x 0.281 (Table 2-6) for SNOX

The average value $\bar{E}$ was calculated as

$$\bar{E} = \frac{(26.5 + 16.0 + 22.1)}{3} = 21.5\ lb/10^{12}\ Btu$$

The standard deviation, S, of the daily emission factors was calculated as

$$S = \sqrt{\frac{1}{(N-1)} \sum_{i=1}^{N} (E_i - \bar{E})^2}$$

$$= \sqrt{\frac{1}{2}[(26.5 - 21.5)^2 + (16.0 - 21.5)^2 + (22.1 - 21.5)^2]} = 5.27 \ lb/10^{12} \ Btu$$

The parameter U was calculated as

$$U = 2.48 * S$$

$$= 2.48 * 5.27 = 13.1 \ lb/10^{12} \ Btu$$

The bias parameter B was calculated using Equation G-3. The B_j components were calculated as follows:

$$B_1 = \frac{dE}{dg} \beta_1$$

$$B_{2/3} = \frac{dE}{d(s+v)} \beta_{2/3}$$ (j = 2, s and j = 3, v were combined)

$$B_4 = \frac{dE}{dHHV} \beta_4$$

$$B_5 = \frac{dE}{dcf} \beta_5$$

where E, g, (s+v), HHV, and cf are each the average value.

Now,

$$\frac{dE}{dg} = \frac{2.205 * (s+v)}{HHV * cf}, \; j=1$$

$$\frac{dE}{d(s+v)} = \frac{2.205 * g}{HHV * cf}, \; j=2/3$$

$$\frac{dE}{dHHV} = \frac{-2.205 * g * (s+v)}{(HHV)^2 * cf}, \; j=4$$

$$\frac{dE}{dcf} = \frac{-2.205 * g * (s+v)}{HHV * cf^2}, \; j=5$$

From Table G-6, the β_j are:

$$\beta_1 = 8\% \text{ of } g$$

$$\beta_{2/3} = 7\% \text{ of } (s+v)$$ (see text on page G-7)

$$\beta_4 = 2\% \text{ of } HHV$$

$$\beta_5 = 2\% \text{ of } cf$$

The term B_1 was calculated as follows:

$$\frac{dE}{dg} = \frac{2.205 * 29.6}{12{,}258 * 26.4} = 2.02 \times 10^{-4} \; (lb/10^{12}\ Btu)/(Nm^3/hr)$$

where $(s+v)$ = average of daily values (Table 5-8)

$= (36.2 + 21.9 + 30.7)/3 = 29.6\ \mu g/Nm^3$

HHV = average of coal heating values

$= (12{,}249 + 12{,}218 + 12{,}306)/3 = 12{,}258$ Btu/lb

cf = average of coal feed rate (Tables 2-4 and 2-6)

$= (25.8 + 26.5 + 26.8) = 26.4$ lb/hr

$$\beta_1 = 2.02 \times 10^{-4} * 0.08 * 106{,}476 = 1.72\ lb/10^{12}\ Btu$$

where g = average of daily values

$= (104{,}820 + 106{,}984 + 107{,}625)/3 = 106{,}476\ Nm^3/hr$

Then,

$$B = (1.72^2 + 1.50^2 + (-0.429)^2 + (-0.429)^2)^{1/2}$$

$$B = 2.36\ lb/10^{12}\ Btu$$

Finally, the total uncertainty was calculated as

$$U = (13.1^2 + 2.36^2)^{1/2} = 13.3\ lb/10^{12}\ Btu$$

TABLE G-1. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF SOLID SUBSTANCES

Analyte Class	Estimated Bias (percent)	Source of Bias; Documentation
Elements Anions SVOC Radionuclides Particulate Matter	5	Departure from isokinetic sampling; value is based on sampling data that show maximum departure of about 5 percent from isokinetic conditions. The bias for collection of solid phase material was assumed to be equal in magnitude to the departure from isokinetic conditions.
Elements Anions SVOC Radionuclides Particulate Matter	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements SVOC Particulate Matter	0	Loss of particulate matter in probe; value of zero results from recovery of particulate matter in probe wash.
Anions Radionuclides	5	Loss of particulate matter in probe; value is an estimate based on use of short probe, with no probe rinse. Consistent with losses of particles observed in long probe and flexible line.

Table G-2. BIAS ESTIMATES FOR LABORATORY ANALYSIS

Source of Bias[a]	Estimated Bias (percent) Organic[b]	Inorganic[c]
Inefficiency Losses	0	2 (solid) 1 (vapor)
Calibration	5	5
Interference Resolution	0	0
Contamination Gains	0	0
Instrumental Shifts	0	0
Matrix Effects	0	0
Theoretical	0	0
Operator Bias	0	0
Tolerance Adjustments	0	0
Uncorrected Blank	0	0

(a) Quality Assurance for Chemical Measurements; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987.

(b) Organic analyses include SVOC, VOC, and aldehydes.

(c) Inorganic analyses include elements, anions, ammonia/cyanide, and radionuclides.

TABLE G-3. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF VAPOR SUBSTANCES

Analyte Class	Bias (percent)	Source of Bias; Documentation
Elements Ammonia/Cyanide Anions VOC SVOC Aldehydes	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements Ammonia/Cyanide Anions Aldehydes	2	Completeness of collection in impinger solutions; based on experience with similar systems, including DNPH for aldehydes.
VOC SVOC	5	Completeness of collection on solid sorbents; based on experience with similar systems, including XAD for PAH/SVOC.
Elements SVOC	0	Loss in probe; value of zero results from recovery of probe wash.
Ammonia/Cyanide Anions VOC Aldehydes	2	Loss in probe; value is maximum likely value given elevated temperature of probe, but no probe wash.

TABLE G-4. CALCULATION OF BIAS ERROR TERMS (β_2) FOR SOLID PHASE SAMPLES

Substance	Sampling Bias[(a)] Errors (percent)	Analytical Bias[(a)] Errors (percent)	β_2[(b)] (percent)
Inorganic			
Elements	5,2	5,2	8
Anions	5,2,5	5,2	9
Radionuclides	5,2,5	5,2	9
Particulate Matter	5,2	5,2	8
Organic			
SVOC	5,2	5	7

(a) See text for origin of individual estimates.

(b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

TABLE G-5. CALCULATION OF BIAS ERROR TERMS (β_3) FOR VAPOR PHASE SAMPLES

Substance	Sampling Bias[(a)] (percent)	Analytical Bias[(a)] (percent)	β_3[(b)] (percent)
Inorganic			
Elements	2,2	1,5	6
Anions	2,2,2	1,5	6
Ammonia/Cyanide	2,2,2	1,5	6
Organic			
SVOC	2,5	5	7
VOC	2,5,2	5	8
Aldehydes	2,2,2	5	6

(a) See text for origin of individual estimates.

(b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

TABLE G-6. ESTIMATED VALUES FOR BIAS TERMS IN THE UNCERTAINTY ANALYSIS

Parameter	Substance	Upper Limit Bias Term β_j (percent)
g		8
s	Elements	8
	Anions	9
	Radionuclides	9
	Particulate Matter	8
	SVOC	7
v	Elements	6
	Anions	6
	Ammonia/Cyanide	6
	SVOC	7
	VOC	8
	Aldehydes	6
HHV		2
cf		2